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THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY.

Publishing Office, No. 42 Pine Street.

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXVIII.—No. 6 Whole No. 450. | NEW YORK, SATURDAY, MARCH 16, 1878 | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors.
G. WARREN DRESSER, Editor.

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☞ An asterisk (*) denotes an illustrated article

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We commence to-day the publication of the Proceedings of the New England Association of Gas Engineers, which, we have no doubt, our readers will find very interesting. The meeting was one of the best ever held by the Association; and our report will be very full and complete, from stenographic notes taken by our reporter at the meeting.

YEARLY TABLE OF GAS BURNING HOURS.

Showing the number of hours from *sunset to* 10 *o'clock* at night, for each month in the year, with the average for each month, and the comparative length of the evenings.

Month.	Total.		Average.		Comparative length of evenings, Hours.
	Hours.	Min.	Hours.	Min.	
June	76	55	2	34	100
July	83	52	2	42	109
May	88	38	2	51	115
August	99	16	3	12	132
April	102	47	3	25	134
September	115	24	3	51	150
March	127	06	4	06	165
February	132	59	4	45	172
October	140	14	4	31	182
November	153	35	5	07	199
January	163	16	5	16	212
December	168	25	5	26	218

The above table was given to us a few days since by General Roome, President of the Manhattan Gas-Light Company of this city, with the remark that he had made it over thirty years ago, and by it he had learned, from a long experience as engineer of the company, to conduct, in a general way, the operations of his retort-house.

An inspection of the table will suggest many useful purposes to which it may be applied in a practical way.

The first column gives the months arranged according to the length of the lighting time in each month, commencing with the shortest. The second column gives the number of hours in each month from sunset until 10 o'clock, P. M. The third column the average number of hours in each day of the different months; and the last column, the relative length of burning hours in each month, assuming the number in the shortest month to be represented by 100, and calculating the other months by proportion.

It is from this last column that the most practical benefit is to be derived.

A few examples will doubtless suggest others to the mind of the careful manager.

For instance; a manager finds that at some time during the summer he has to reset his benches, or a portion of them, when shall he begin, and when must he have his repairs completed?

From this table he sees that June is the month when he is likely to send out the least gas, and, consequently, is the time when he can best spare the largest number of benches, and that by November he will require double the retort power that he does in June. So that, if he is prudent, he will so arrange his work that he will have enough retorts for his ordinary send-out in June, with a slight extra allowance for increase, and for dark days, and that everything that is to be rebuilt will be cleared away and ready for new work by that time, and then push his repairs to completion as rapidly as he can, consistently with the requirements of good work and other circumstances. By the end of July he will require 10 per cent. more retort power than in June; by the month of August 30 per cent. more, and so on, until December calls upon him for over double the number of retorts required in June.

The month of September appears to be about the average month for the year.

The table is also useful in giving an accurate guide as to the amount of coal required for each month. This may be especially useful where the coal supply is obtained continuously throughout the year, as is the case in many works having facilities for obtaining the coal fresh as it is wanted.

The advantages in results obtained from "fresh mined" coal are known to all; and where it is possible to secure coal in this way, the above table gives a ready means of calculating the relative amount required for each month; and, so, many other practical uses of the table might be pointed out.

But there is another place where the table may be found useful, and that is at the desk of the company's cashier.

It is no unusual question for the consumer to ask; "why is my bill so much larger than last month." A reference to the last column of the table will show any reasonable consumer that for the month of September his bill *ought* to be half as large again as for the month of June; and for the month of November twice as large, etc., etc. While to the unreasoning consumer (of which every company has its share) it may at least furnish a temporary amusement, and perhaps permanent mathematical improvement, to take the figures home with him and "see if they are right." Many

people are fond of working out problems; and if the complainer can be induced to take this table home with him, and compare it with the Almanac and figure it out for himself, he may be able to see that one month differs from another month in darkness.

The table may also be used as a check against errors in taking indexes. If a test of thirty years use is of any value, the above table has had it; and we commend it to all interested, whether in the retort-house or the office, as reliable and likely to be of service in almost any company. Of course the hours are calculated for New York city, and can be easily adapted to any other locality.

We give below the relative length of evenings, arranged in the order of the months of the year, commencing with June, and representing the number of hours in that month by 100.

June	100
July	109
August	132
September	150
October	182
November	199
December	218
January	212
February	172
March	165
April	134
May	115

CARBONIC OXIDE.

Is It a Harmless Anæsthetic or a Virulent Poison?

[By Henry Morton, Ph.D., President of the Stevens Inst. of Technology.]

[Concluded from page 93.]

The various quotations given thus far make it, we think, abundantly manifest that, in the opinion of the standard writers on chemistry, as expressed in their publications, "carbonic oxide" is one of the most virulent and dangerous gas poisons, the presence of which even to the extent of a few per cent. in the air of a room renders it utterly unfit for breathing and often even fatal.

In face of this, however, we have the fact that certain authors have made experiments with this gas *as an anaesthetic*, and have written papers about it in this character, and have compared its effects with those of chloroform and other anæsthetics; and have even given it, in some of their statements, a preference to chloroform as an anæsthetic agent.

Now this statement of the case, which, moreover, is *literally correct*, would certainly convey the impression that the dangerous properties, as stated by the authors whom we have quoted, had been overestimated or exaggerated.

Before forming a judgment, however, it will be safest for us to refer to the original publications of these gentlemen, and see for ourselves exactly what they *do* say on the subject.

Thus, in the first place, we have an article *On the anaesthetic action of gases.—Carbonic Oxide*, by Dr. Ozanam, published in the Archives Générales de Médecine, Paris, 1857. 5th Series, Vol. IX., p. 159. This article covers about 20 pages, and we must therefore content ourselves with a few extracts, so selected, however, as to give the character of the whole publication.

In the first place, he announces the theory on which his experiments were based in the following words:

"The more carbon bodies contain, and the more easy their elimination, the stronger must be their anæsthetic property."

Then, after some general remarks, and a description of the method used in preparing the gas, he continues:

"Our experiments and observations amounted to 30 in all, of which 25 were made upon rabbits and five upon men; among the latter there are two pertaining to Samuel Witte. We cannot give here a full report of all these cases; it will be quite sufficient to recount in a few words the most important cases.

"A.—*Action of carbonic oxide when inhaled.* The phenomena produced by the inhalation of carbonic oxide naturally divide themselves into four periods:

"Premonitory stage.
"Period of excitement.
"Period of anæsthesia.
"Death or recovery.

"FIRST PERIOD—PREMONITORY STAGE.

"A fine tube screwed to a bladder full of carbonic oxide was introduced into the mouth of a rabbit, firmly held, and whose nostrils had been stopped up; an assistant pressed on the bladder, and the animal forced to breathe by its mouth, inhaled the gas mixed with atmospheric air.

"During the first five or six inspirations the animal does not make the least effort; it is motionless, stunned, as if it were under the impression of some danger which it suspected, yet did not know, and of whose violent effect it was not yet conscious.

"I notice this stage, because it contrasts by its calmness with the active effects of a gas so powerful as carbonic oxide.

"SECOND PERIOD—EXCITEMENT.

"But at the end of 15 to 30 seconds the scene changes; the animal trembles and attempts to escape. Next these voluntary movements are replaced by strong convulsions, various in their form, contractions, turning back of the head, trembling, etc. This lasts from one to four minutes, according to the vigor of the subject, and according as to whether the gas is applied continuously or intermittently. * * *

"THIRD PERIOD—STUPOR.

"The convulsive stage is quickly followed by the period of collapsus or stupor. All motion ceases, the body falls down as an inert mass, the head hangs, the eye is wide open, the pupil dilated, sight almost gone, the four limbs paralyzed, the urine flows involuntarily, the heart beats grow slower (from 180, the normal figure, to 100), respiration also grows slower, it falls to 60 to 40, while in the normal state it is about 100 respirations per minute.

"If the inhalation is continued, the act of respiration becomes still less frequent; it only occurs every five or ten seconds, by a general and sudden effort resembling hiccough. But prolonged to this stage the anæsthesia becomes dangerous, and must be closely watched, since the inspiratory nerves are almost paralyzed, and the state of apparent death approached.

"The pulse and the state of the respiration are then the surest guides to be followed in order to regulate the effect of the gas. The less frequent they become the greater the danger.

"All the phenomena just described take place in a space of time varying from one to six minutes, according as to whether we proceed in a continuous or in an intermittent manner.

"FOURTH PERIOD—RECOVERY OR DEATH.

"A. Recovery.—The inhalation is stopped, the animal left to itself. For one to three minutes the anæsthesia remains complete; one could believe the animal dead, were it not that auscultation still reveals the enfeebled beating of the heart and some occasional efforts at respiration. Soon regular life begins again, respiration is reëstablished; the heart gradually regains its normal figure, and even passes it a little (from 10 to 15 pulsations). At the end of from two to four minutes sensibility returns to the ears, the skin is still insensible. The animal rises to its fore feet; its hindquarters are still paralyzed. At the end of six minutes one can still, in a large majority of cases, run a limb entirely through with a stylet without causing a sign of pain. After 8, 10, 14 minutes, according to the subject, and the degree of anæsthesia, the animal returns to its normal state.

"B. Death.—The passage from stupor or apparent death to real death is sudden and unexpected, resembling in this respect sudden death by chloroform. The heart and respiration, already much enfeebled, are suddenly and forever arrested. In one case death resulted after two minutes inhalation of the gas; but, a thing worthy of remark, in the course of our experiments, a rabbit submitted to chloroforming died in a shorter space of time (1½ min.) * * *

"ACTION OF CARBONIC OXIDE ON MAN.

"Can carbonic oxide be inhaled by man? Everything points to the belief that it can, above all if care be taken at the same time to breathe a certain quantity of atmospheric air. Without doubt extreme caution is necessary; but the 25 experiments which we made, and of which several have been repeated upon the same animal, show that the use of this gas is not so dangerous as was formerly believed, since we have but one case of death among animals so delicate as rabbits.

"As affording valuable insight into this question, we give here from Orfila (Toxicologie, Vol. I., p. 552, 1843), the two experiments made by Samuel Witte, on himself.

"Experiment 1. In the first Samuel Witte experienced convulsive trembling and vertigo, with an almost complete suspension of sensibility after two or three inhalations of the gas. Languor, cephalalgia, and a state of weakness, followed these phenomena.

"Experiment 2. In the second experiment he almost instantly fell backwards, deprived of motion, pulse and sensibility, after making 3 or 4 strong inhalations, having first emptied his lungs. The breathing of oxygen gas was followed by better effects.

"He still, however, experienced a convulsive agitation and a very severe headache. It was some time before he recovered sight, and he was a prey to nausea, vertigo, and to alternations of chills and fever. He had finally a great inclination to sleep, which was broken and feverish. (Biblioth. Britann. des Sciences et Arts, T. LXI).

"We notice again in these interesting facts the two periods of excitement and of collapse proper to anæsthesia; the insensibility also, as well as the too violent effects of the gas when it is respired pure, as in the second experiment.

"From this we are justified in concluding that carbonic oxide can, with precaution, be respired by man, that it also produces anæsthesia in this case, and that by mixing atmospheric air with it its strength and effect can be regulated at will."

After this follows a description of experiments on the local application of this gas, and other matter not related to our present subject; but what we have above quoted is every word that this author states in reference to *the action of carbonic oxide on man.*

This, taken in connection with his earlier statement, that—"Our experiments amounted to 30 in all, of which 25 were made upon rabbits and

5 on men; among the latter there are two pertaining to Samuel Witte," is certainly, to say the least, very curious. Of *our* five experiments two are quoted from another writer, and the remaining three are passed over in silence, or were only local applications of the gas to diseased surfaces. The justice of the conclusions, drawn from such data, may well be questioned by any one who does not, like M. Ozanam, enter upon the subject with a ready-made theory which he desires to support. The facts related by this author are, however, valuable, and give a very different complexion to the subject from that which appears in certain general references to his work which we have not met with, in more than one publication.

Turning next to the Comptes Rendus, 1857, T. XLIV., p. 96, we find an article entitled "Mémoire sur l'action anæsthetique du gaz oxyde de carbone, par M. G. Tourdes."

Here we encounter, near the beginning, a most encouraging phrase, for the author, from whose other publications (pamphlet on the Strasbourg poisonings with water gas), and his experiments, quoted by Woodman and Tidy, we should hardly expect such an opinion, says: "The two fundamental facts are the harmlessness of the gas and its anæsthetic action."

That this is, however, only a careless form of expression very soon appears, for a few paragraphs further he goes on. "When we prolong the action of the gas the animal succumbs. It is necessary to arrest it as soon as the anæsthesia is complete. Death may be sudden, with cries and convulsions; but more frequently it is peaceful. The transition from sleep to death is insensible, respiration is arrested, the carbonic oxide seems to act by paralyzing the muscles of respiration. * * * "In establishing the anæsthetic action of carbonic oxide, it is a duty to point out at the same time the dangers which result from the gaseous form and difficulty of application of this agent, so as not to take the responsibility of the accidents which will occur one of these days." This seems an unkind way of referring to a "harmless anæsthetic," whose only "difficulty of application" seems to be the trifling one that during its administration "the transition from sleep to death" may be "sudden," or may be "insensible"; but is too probable to make the author willing "to take the responsibility of the accidents which will occur" if it is used.

It would seem, therefore, that even these authors who have been referred to as having proposed and used carbonic oxide safely as an anæsthetic agent, upon man as well as upon lower animals, and who have compared the symptoms to those of chloroform, do not encourage its general application very strongly when they are directly consulted, and fully quoted, but leave us with the same old impression derived from the chemical literature of the subject, that carbonic oxide is a very dangerous gas poison of which we should beware.

It has, however, been said that, granting this, still ordinary coal gas is also a poison, and that the substitution of one poison for another is a matter of no practical moment to the people who fall victims to either, and still less to those who escape both.

Now, in reply to this, we would, in the first place, call attention to the very decided opinion expressed incidentally by some of the authors already quoted, and founded on extended experiments, to the effect that *the only practically poisonous constituent of coal gas is its five to seven per cent. of carbonic oxide.*

Next, we would ask attention to a few other quotations of statements directly bearing on these points.

Thus, Eulenberg in his Handbook of Technical Hygiene (or hygiene in connection with manufacturing processes, etc.), on page 38 declares hydrogen to be perfectly harmless.

Werker, in his Toxicology, does not mention hydrogen at all among poisonous substances.

Miller, in his Chemistry, p. 41, says: "Pure hydrogen, though it cannot support life, is not poisonous; and, when mixed with a certain proportion of air has been breathed for some time without inconvenience."

Such quotations might be indefinitely multiplied, but it is, we presume, accepted on all hands that hydrogen is not a poisonous gas.

Passing next to

MARSH GAS.

Miller, in his Chemistry, Vol. II., p. 236, says that it is "not injurious to life if diluted with air."

Leblanc, in the Ann. de Chim. et de Phys., 3d Series, Vol. V., p. 239, says that "marsh gas and olefiant gas are not injurious."

Eulenberg. Handbuch der Gewerbe Hygiene, already mentioned, at p. 368. says: "The action of marsh gas on the animal organism is in no way injurious to health; if headache, dizziness, fainting and similar effects are produced it is certainly mixed with carbonic oxide. In coal mines such mixtures not unfrequently occur. According to the amount of carbonic oxide present, the workmen will be more or less affected with symptoms which never occur with pure marsh gas.

"Rabbits can remain in an atmosphere containing five per cent. of marsh gas for 20 minutes without showing anything abnormal.

"According to Richardson, 70 to 80 per cent. of the gas is necessary to produce an anæsthetic sleep. In experimenting with animals this effect was not observed."

Fowne's Chemistry, Philadelphia, 1869, p. 169. Under marsh gas. "It is not poisonous, and may be respired to a great extent without apparent injury."

Hermann, Berlin, p. 275. "Marsh gas has been proved to be indifferent."

Leblanc. Comptes Rendus, 1842, T. XIV., p. 868. "But some experiments made on animals demonstrated to me that even a very feeble dose of carbonic oxide may occasion very serious, and even fatal accidents.

"Thus, a dose of five per cent. in air will instantly kill a sparrow; a dose of one per cent causes death in two minutes or more. Marsh gas on the contrary, in a dose of one per cent., does not produce any serious effect even in a much greater length of time.

"Olefiant gas diffused in air to the extent of some hundredths does not produce any ill effects."

ETHANE,* ($C_2 H_6$).

Eulenberg, p. 398. This author, after describing four experiments on animals, remarks: "The foregoing experiments prove undoubtedly the anæsthetic action of ethane; in this respect it is the first one of the ethyl compounds known as an anæsthetic. Mixed with a sufficient quantity of air it does no permanent harm, since it does not prevent the blood from absorbing oxygen." This last remark is made in reference to the observation that carbonic oxide seems to produce its fatal effects by entering the blood, to the exclusion of oxygen whose absorption it thus prevents.

Hermann, p. 276. "Ethylene gas ($C_2 H_4$), I have proved on myself to be mildly intoxicating, almost like laughing gas."

From all this it would certainly seem to be very evident that, in the opinion of competent judges and authorities, the constituents of ordinary illuminating gas, other than carbonic oxide, bear no sort of comparison with it in poisonous properties, even if they have any serious ill effect at all.

To sum up then, in a few words, it seems to us that as far as the weight of authority goes, carbonic oxide stands condemned as a rank poison, very exceptionally dangerous as compared with the other constituents of illuminating gas.

This by no means deprives those gentlemen who think differently of their right to their own conclusions; but, on the contrary, tends to establish their claim to originality, and shows that their ideas are exclusively their own, and have not been anticipated by any prior publications.

There still, however, remains another standpoint of observation from which this question, in its practical application to water gas, may be viewed with propriety.

This, I think, I can best express by describing in the first instance a parallel but hypothetical case.

Suppose that the safety-matches, made with amorphous phosphorus, were first invented and introduced, and that the question were then asked about the desirability of introducing "parlor matches."

We might say, "safety matches *may* cause loss of life by fire, or, perhaps, if not made with strict care might be to some degree poisonous; but the parlor matches are much more likely to cause a conflagration and are much more poisonous—shall we, therefore, discourage the parlor match?" Prudence certainly says: don't add to the existing risks to life and property; but a larger range of view might disclose such considerations as these. The risks in either case are very small. Both articles are harmless under normal conditions. The knowledge of danger will make people more careful, etc.

If, then, there is some decided gain to be expected by the public at large from the parlor-match, an enlarged philanthropy may even advise that the additional risk should be run, and "the greatest pleasure of the largest number" secured, even at the cost of a few more houses consumed or children poisoned.

When, therefore, it shall appear that the introduction of water gas is to benefit the world at large, it may well be urged that the benefit is worth what it costs in added risk.

Apropos of the match illustration I have a suggestion of encouragement to those who are engaged in developing the water-gas manufacture, which it gives me great pleasure to make; for I really have no interest on either side, and entertain the most friendly feelings for those engaged in promoting "water-gas." My suggestion is this:

The safety-match was put in the market at least 20 years ago, and yet the inflammatory and poisonous "parlor-match" still triumphs, thanks to its superior convenience.

Nitro-glycerine entered the world heralded as it were by a holocaust of some hundreds of human beings, and is still the very type and example of destructive agents; yet, on account of its convenience, economy, and efficiency, it is to-day *the* explosive of the world in all engineering applications. It is also practically less destructive than

* We introduce a reference to ethane here, not of course because we regard it as a constituent of coal gas, but to provide for future reference, and to make this class of citations complete.

gunpowder, because, among other things, a sense of its ability to destroy causes it to be handled with caution. The "moral" hardly needs statement. When water-gas is a successful manufacture, its capacity for evil, when misapplied, will neither check its application nor render that application practically safer by being depreciated.

I will take advantage of the present opportunity to correct a mistake of my own, which has only just come to my knowledge. In my report on the Harrisburgh gas, published in this Journal, of Nov. 2d, 1877, I gave the increase in amount of carbonic acid, produced by the combustion of a given volume of that gas, as 70 per cent. greater than that produced by the combustion of an equal volume of ordinary coal gas. On referring recently to my original notes, I find that this 70 should have been 50. The number 70 occured as the result of one of the preliminary calculations, and was accidentally copied into my report.

This mistake is one of those which one would believe impossible if they did not occasionally happen.

Fortunately, large as the error is, it does not involve anything affecting the general conclusion reached, whether a water-gas produces 50 or 70 per cent. more carbonic acid than an average coal gas, is simply a question of degree.

One of my critics seems to suppose that the relative quantities of carbonic acid from coal and "water-gas" depend upon the products of combustion of marsh gas and of carbonic oxide. Here he is himself in error.

The large yield of carbonic acid in water-gas comes, not from its containing carbonic oxide as a substitute for marsh gas, but from the large percentage of illuminants which it contains, and which, being rich in carbon, yield excessive amounts of carbonic acid. Thus olefiant gas yields twice as much carbonic acid as marsh gas, and other members of the olefine series progressively, three, four, five, etc., times as much acetylene; also, pure benzole, six times as much, and the various members of the paraffine series such amounts as are indicated on page 68 of the present volume.

But it may be suggested, if the illuminants are the cause of this increased yield of carbonic acid, must it not be more than cancelled by the gain in candle power.

This does not, however, follow. The very interesting record of results, by Frankland and Thorne, republished on page 78 of this volume, from the *Chem. News*, shows that where marsh gas is replaced by carbonic oxide, a very much larger proportion of an illuminant is needed to produce the same candle power. This drawback is, therefore, inherent in any gas which replaces marsh gas by carbonic oxide.

It is worthy of note, also, that very rich, or high candle power, coal gas will have a similar drawback, as compared with a poorer one, and will tend to vitiate the air of rooms to a greater degree.

It is no practical answer to this objection to say that, with a higher candle power, less gas in proportion is used. This is not true within the range of moderate variations, such as are now considered (16 to 20 candle power.) The consumer, with a richer gas, rejoices in his superior light, and turns on an extra burner to realize his advantages more thoroughly.

We are not referring to extreme cases, or maintaining that in a nearly pure marsh gas there would be a better condition of affairs in this respect than in a rosin gas; but, simply, that within an ordinary practical range high candle power may not always be an unmixed advantage.

As regards the actual fact of the production of carbonic acid, by coal gas and water-gas on burning, I made the simple experiment of exploding known volumes of coal gas and "water-gas",* and determining the volumes of carbonic acid actually produced, and of oxygen actually consumed in that operation.

Thus 100 measures of the illuminating gas from coal, supplied by the Hoboken Gas Company, as it comes from the burners in my laboratory, yields 64.945 measures of carbonic acid, while 100 measures of "water-gas," supplied by the Municipal Company of New York, as it comes from a burner in the School of Mines, yields, on combustion, 99.93 parts of carbonic acid.

The amounts of oxygen consumed are about the same, in each case, being in fact—

Hoboken gas 133.375 per 100 vols. of gas.
Municipal gas 151.24 " " "

The reason of this large yield of carbonic acid from water-gas, as I have already stated, is to be sought not in carbonic oxide, but in the excessive amount of illuminants which water gas *requires* to bring it up to a good standard.

Thus, while a coal gas with 6 per cent. of illuminants will give 16 candle power, a water-gas, with 18 per cent. of illuminants, will only give 22 candles; or, in other words, requires 300 per cent. increase af illuminants for 40 per cent. increase in light. This is necessary, because as Frankland's article, already cited, shows while marsh gas is not an illuminant, and contributes nothing to the production of light, yet carbonic oxide is a sort of *negative illuminant*, or absorbent of some 20 per cent.

The following analyses of some "water" and coal gases, will show these and some other curious relations.

Analysis of "Municipal gas," made in June, 1877, in which the presence of benzine or paraffines was first noted by me.

Carbonic acid	.21
Oxygen	.14
Benzine vapors & like illuminants	1.14
Olefiant gas and like illuminants.	15.12
Carbonic oxide	26.18
Hydrogen	27.29
Marsh gas	25.43
Nitrogen	4.45
	99.96

In this and other cases I used the popular word "benzine," to indicate, in a general way, a mixture of paraffines, such as the benzine or petroleum naphtha represents. I have since abandoned the use ot this word to avoid confusion with benzole, C_6H_6, which is, of course, reckoned in an ordinary analysis among the "olefines, or illuminants." Of course no one supposes that benzole is an "olefine"; but, as for practical purposes, its behavior in an illuminating gas is identical with an olefine, this loose way of indicating the group of bodies absorbed by Nordhausen acid or bromine is not objectionable.

Ordinary Coal-gas.

	Russell.	A. Wurtz		W. D. Thompson.
Carbonic oxide.	4.167	12.9	6.6	5.62
Carbonic acid...	1.950	.3	3.6	.46
Oxygen.....	.139	——	——	H_2O 2.48
"Olefines".....	5.504	3.8	6.4	3.86
Hydrogen.....	45.847	50.2	45.6	45.43
Marsh-gas.....	40.948	32.8	34.9	39.93
Nitrogen.....	1.445	——	2.7	2.22
	100.000	100.0	99.8	100.00

* By "water-gas" I, of course, intend the illuminating mixture so-called.

It is a curious circumstance that the water-gas shows less hydrogen, as a rule, than the coal-gas.

Municipal gas. Dec. 12, 1877.

Carbonic acid	.371
Oxygen	1.021
"Olefines"	17.363
Carbonic oxide	27.893
Hydrogen	23.487
Marsh-gas	24.612
Nitrogen	5.235
	99.982

In this analysis the fraction of a per cent. of paraffines was not removed, and the hydrogen and marsh gas members are, therefore, in error to a corresponding amount.

Harrisburgh water-gas, collected January, 1878.

Carbonic acid	3.691
Oxygen	.421
Olefines	12.376
Carbonic oxide	26.190
Hydrogen	31.865
Marsh gas	21.631
Nitrogen	3.788
	99.962

Paraffines not determined in this particular case, and thus hydrogen and marsh gas figures are subject to correction.

I have lately heard my analyses criticised because they did not foot up 100.

This is a matter of taste, however, in which I claim the right of pleasing myself. These determinations involve a considerable amount of calculation. I have carried my figures out in them to the third place of decimals, and neglected all beyond. This causes a slight deficiency in the summation of results. It would be easy enough to "pad" the figures to a round sum, and even if this was all done in one item it would hardly introduce an error equal to that which probably exists from other causes, and would certainly be of no practical importance whatever. For my own part, however, I think that the actual numbers look just as well, and are no less honest than a round sum obtained by making ·286 = ·290, or the like.

On the Hayford Process and Apparatus for Preserving Timber.

By Edward R. Andrews, of Boston.

[Continued from page 93.]

During the steaming process, a pipe in the bottom of the cylinder is kept open, to allow the escape of the condensation. By the same means is maintained a current of hot air, which is very efficacious in drying wood. The time necessary for drying wood in this process depends upon the quantity of moisture to be got rid of, and the size of the timber. Four or five hours suffice for boards and 2-inch plank, while ten or twelve are required for heavy timber.

Albumen coagulates at 140°, so that the result —the only one claimed for the Burnettizing and Kyanizing processes—is easily secured; but the sap and moisture cannot be got rid of, until they have been turned into vapor. Hence the necessity for continuing the steaming process until it is certain that all the portions of the wood containing sap and vapor have been heated to above 212°.

When this point is reached, the direct steam is cut off, all valves opened, and the air pumps kept at work to drive from the cylinder all the steam, vaporized sap and condensation, which remain in the cylinder; in other words, to free the cylinder entirely. This occupies about an hour, and closes the second part of the process. Heat is constantly

maintained through the radiation from the steam coil. We then commence to pump a vacuum.

The cylinder is once more made tight. The valves in the pipes connected with the pump, which made it a force pump, are closed; and those opened, which change it into an exhaust or vacuum pump. The vacuum pump is then set at work. There is, at this time, no appreciable amount of moisture in the cylinder, except what exists in the pores of the wood in the form of vapor. The vacuum pump has worked but very few minutes, however, when the vapors, partly condensed in the pump, begin to pour from the nose of the pump, and they continue to come for hours, filling, if the wood be green, many barrels with sap.

This shows the effect of the steaming process. If a cold vacuum had been pumped, when the cylinder was first closed, it could be easily done in less than an hour, but no water would have come through the pump, and the wood would not have parted with its sap. It is a common mistake to suppose that a vacuum alone will withdraw sap from wood. But after steaming, when the sap has been turned into vapor, then it is drawn out by the force of the vacuum pump, yet the vacuum is reached very slowly, on account of the vast quantity of moisture which is drawn from the wood; five or six hours often elapse before the vacuum gauge indicates 24 or 26 inches of vacuum. But the sap being withdrawn, the vacuum extends into the interior of the wood, if it can be properly so expressed, so that when the oils are let in, they are absorbed into the very heart of the wood.

This brings us to the last step in the Hayford process, namely, the impregnation with the preserving material. During the drying process, steam has been admitted to the coil in the oil tank, bringing the temperature up to about boiling point, to render the oils very limpid and penetrating. Creosote oil is heavier than water, weighing about 9¼ pounds to the gallon, it congeals at about 60°, so that heat is needed to flow freely.

Impregnation.

I have previously explained to you that oil is admitted to the cylinder through a series of perforated pipes, arranged around the inside of the cylinder. A pressure of about 60 pounds to the square inch is brought to bear upon the top of the oils in the oil tank; this pressure, together with the drawing force of the vacuum, make a force of about 75 pounds to the square inch, with which oils are sucked and driven into the cylinder. Every stick is at once bathed with oil. The wood—being in a soft, somewhat spongy condition, the fibres porous, and the pores open—absorbs at once the hot, penetrating oil. If the wood be of a porous character, like pine, it absorbs all the oil required with the first flowing over of the oils, without pressure; but if the fibre be solid and close, and the timber of large size, a further pressure of from 60 to 150 pounds is needed during a certain length of time to make the impregnation complete. But the wood having been put into a condition to absorb the oil, the impregnation is more rapid and more thorough than by the Bethell process, where no other means are relied upon than a pressure upon hard, air-dried timber in a cold vacuum.

The process is now completed, and the doors at either end being opened, the lumber treated is withdrawn, and another charge takes its place.

Value of Process.

Now let us retrace our steps, and see whether, practically as well as theoretically, the advantages claimed for the Hayford patents have been realized.

I have shown you that to preserve wood from decay, it must be placed in the following conditions:

1. It must be rendered non-fermentable by the coagulation of the albumen of the sap.

2. *Dryness* must be secured by the abstraction of the sap and moisture contained in it, as well as any sugar or acids, which would have a tendency to ferment.

3. *Dryness* and a pure woody fibre being secured, these conditions must be maintained by protecting the wood in some way from air and water afterwards.

In reply, I claim:

First, that inasmuch as albumen coagulates at 140°, and that all the sap containing albumen is to be found in the sap-wood, and that it has been steamed to 240° or 280° Fahr., the albumen has thus been rendered non-fermentable. Moreover, creosote oil contains the most powerful coagulator of albumen known to science—carbolic acid; hence, when injected into the pores of wood, it doubly secures it from fermentation.

Secondly. By the action of the steam heat, and the subsequent use of the vacuum pump, the sap and water held in the wood have been vaporized and withdrawn from the pores of the wood, leaving a pure woody fibre. Nothing liable to ferment remains in the wood.

(This system of drying lumber may be made very valuable for carpenters. In twenty-four hours green lumber can be seasoned more completely than in an ordinary dry-house in six weeks. For this purpose the drying process should be continued for some time after the vacuum has been reached, the heat being kept up by the radiating coil of pipe.)

Thirdly. Freedom from liability to fermentation and dryness being secured by the earlier processes, the wood is made water-proof and air-tight by injecting the pores with creosote oil.

Creosote oils are also called dead oils, or the heavy oils of tar. They contain from five per cent. to 15 per cent. of carbolic acid, and several other highly antiseptic and preservative constituents, besides paraffine, naphthaline, etc., which all play their parts in the preservative processes. Heavy oils are produced in the distillation of crude coal tar, as it comes from the gas houses. They come off after the light and volatile aniline oils, say at a temperature of 300° to 600°. The residuum is pitch.

Creosote oil, forced into the pores of wood at a high temperature, being far more penetrating than any other oil, works its way through the pores until it covers every fibre with a protecting film. It resinifies in the outer pores, and, impacting there, keeps the main body of oil within, and, being insoluble in water, it forms a water-proof and air-tight covering to the wood, and maintains absolute *dryness*. No matter where the wood may be exposed, it is protected from absorbing any fermentable substance. Hence, decay is rendered almost impossible.

The preservative qualities of the heavy oils of tar are not due, solely or chiefly, to one or more of its component parts, although several are highly esteemed as preservative substances; but their efficacy is due, chiefly, to the thick, greenish oil itself, which is *insoluble*. It is this quality, *insolubility*, which gives to the heavy oils of tar their superiority, as preservatives, over chloride of zinc, sulphate of copper, or corrosive sublimate. These latter only coagulate the albumen, they offer no protection whatever to the wood itself; the woody fibres are as much exposed as ever to absorb destructiue agents. But when wood has been injected with creosote oil, which works insidiously through its fibres, not only is the albumen coagulated, but the whole structure is so absolutely preserved and protected, that its indestructibility is assured, except from actual wear. It is benefitted on this score, also, as it becomes harder by time. Creosoted wood is the only wood which seems to improve with age. The oil seems to metalize the fibre like iron. Soft wood becomes hard, like oak. Sap wood becomes as hard and durable as the heart-wood.

In the early part of my remarks I stated that the Hayford patents, for preserving wood, covered a system which is adapted to the wants of this country. This is mainly, as you have observed, because it is able to cope with green lumber. It can receive it from the sawmill, and in 24 hours thoroughly season and preserve it. In fact, to do good work, it is essential to have green wood. It is precisely in this condition that wood will readily absorb creosote oil, when the moisture has been withdrawn. In a living tree, the fibres and pores of wood are not hard and flinty, like those of kiln-dried or air-seasoned lumber, but are soft and porous. The cells act as so many millions of pumps, to transmit the sap from the roots to the leaves and return it again to form the annual layer of wood growth. When the sap has been withdrawn from wood in this condition, as has been described, without hardening the fibres, the cells and fibres are just as ready to receive or transmit creosote oil as sap itself.

Creosoted Wood will not Decay.

I have assumed that you are all familiar with the fact that thoroughly creosoted wood will not decay. This is a fact, proved by the accumulated evidence of 40 years in England. Creosoted wood has never been known to decay. Engineers in this country need not wait a generation to learn that this is so. It was accepted as proved in England 30 years ago, and in engineering works the strongest testimonials of the value of creosote oil, as a preservative against decay, are recorded by all the great constructive engineers in Europe.

There is scarcely a railway in England which does not use creosoted ties, bridge timbers and platforms, and the same roads use them to-day, which began their use in 1840. The Belgian system of railways, which is under government management, uses creosoted ties solely, and the same is true of all the railways of Northern Europe.

Some engineers here have told me that ties wear out before they rot. That may be true in some cases; but I ask, if creosoted ties do not wear out in 20 years on the great roads in England, why should they wear out here? It is a remarkable fact that it is difficult to find any old ties in England for specimens of creosoted work. These specimens from the Great Northern Railway of England, which have been in wear from 10 to 14 years, were actually taken out of the road-bed to be sent to me. No piles of old ties lying by the side of the tracks, only fit for fuel, are to be seen in Europe as in this country.

My belief is, ties begin to decay before they begin to wear out. As a rule, ties are half buried in the ground in a green state, full of sap in a fermenting condition. Wet rot sets in at once, favored by the exposure to alternate dryness and moisture, particularly under the rail, where the surface begins to decay at once, hastened by the rust from the rail; at the same time the spike driven into the moist wood begins to corrode; water works down by the side of the spike, the spike loosens and plays, and then comes the trip-hammer action of the rail every time a train passes over it. It is no wonder the tie cuts and is thrown out, often within the first year.

[To be concluded.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

THIS IS a recognized official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE.

TERMS

SUBSCRIPTION—Three Dollars per annum, in advance.

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NEW YORK—AMERICAN NEWS COMPANY, 119 and 121 Nassau S
BOSTON—S. M. PETTENGILL & Co., 6 State Street.
PHILADELPHIA—PRATT & Co., Corner 9th and Arch Streets.
Germany—B. WESTERMANN & Co., of New York.

SATURDAY, MARCH 16, 1878.

Official Report of Examinations of Gas for two Weeks ending Mar. 9, 1878, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Date. Feb. 1878.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
25	Between 10 A. M. and 3 P. M.	17.00	17.46	19.67	16.72	17.52	
26		18.16	16.10	19.66	16.25	17.45	
27		16.41	16.41	19.57	16.27	17.08	
28		16.49	16.13	18.02	17.14	17.73	
Mar. 1		16.12	16.51	18.33	17.01	17.47	
2		16.63	17.31	18.40	16.60	17.29	
	Average	16.80	16.65	18.94	16.66	17.42	
4		15.96	15.44	19.03	17.00	17.52	
5		16.09	16.82	19.53	16.80	18.12	
6		17.29	17.77	22.25	16.94	17.40	
7		16.71	17.87	21.26	17.07	16.90	
8		16.86	18.32	20.47	16.67	16.52	
9		17.45	17.47	21.32	17.52	16.73	
	Average	16.72	17.28	20.64	17.00	17.19	

Sugg-Letheby burner.
E. G. LOVE, Gas Examiner.

Cost of Strikes.—For every week lost in a strike a certain number of week's work at the higher wages struck for, is required in order to avoid positive loss to the workmen. Thus in the case of a strike of six month's duration for an advance of 10 per cent. in wages, five years' labor at the higher rate will be required in order to make up the positive loss incurred in the strike.—*Coal Trade Journal.*

Eighth Annual Meeting of the New England Association of Gas Engineers.

[OFFICIAL REPORT.]

The Eighth Annual Meeting of the New England Association of Gas Engineers, was held in the Tremont House, Boston, on Wednesday, February 20, 1878, commencing at 12 o'clock, M., and was called to order by the President, Samuel G. Stiness, Esq., of Pawtucket, R. I.

The number of members in attendance during the session was fifty-six.

The President—We have with us to-day many gentlemen who are connected, not directly, with the manufacture of gas, but with the manufacture of the different articles which are brought into daily use with us. Is there any action which the Association will take in inviting those gentlemen to seats in our Association?

Mr. M. S. Greenough—I move that a committee be appointed by yourself, to invite gentlemen not members of our Association, strangers in town, interested in our meetings, who have not been already invited to attend this session of our Association, and take part in our discussion.

The Secretary—Does that mean the gentlemen who are connected with the American Association, or any gentleman visiting Boston?

Mr. Greenough—I had express reference to gentlemen who were in direct communication with gas companies—visiting strangers who are well known to the profession.

The Secretary—We have gentlemen here that are connected with the different branches of our profession—coal men and meter men, and others. I desired to know how far Mr. Greenough desired his motion to go.

Mr. Greenough—That was not part of my motion. I am willing to have it amended in that respect. But I meant those connected with gas companies.

The President—Mr. Greenough's motion is that gentlemen directly connected with gas companies be invited to take seats in the Convention.

The Secretary—By vote of the directors, previously adopted, the president and secretary were authorized to extend invitations to such gentlemen as they saw fit; and many of the gentlemen invited are here.

Mr. Greenough—I did not mean to embarrass the action of the committee in any way. I thought some such motion was necessary and I made it. I am ready to make it as wide as the directors have made it.

The President—If there is no objection such a committee will be appointed, and I will designate as members of it, Mr. Malcolm S. Greenough, Mr. Cabot, and Mr. Slater.

The President—Gentlemen will give their attention to the reading of the records of the last semi-annual meeting. Is it desirable that we have the entire records read, or only a synopsis of the records? Perhaps the secretary will give us a synopsis.

The Secretary—Before proceeding to read the records I will state to the members, that at the meeting of the directors last night, the subject of the annual assessments was introduced for their consideration, and it was voted unanimously that the assessment for the present year be three dollars, instead of five dollars as heretofore. My clerk is here ready to take the assessments. If the gentlemen, during the progress of the meeting, will step to the table quietly and pay their assessments, we will be very happy to receive them. The rule that has been adopted is this: That no one can vote until he pays his assessment.

The Secretary read a synopsis of the records of the last meeting.

On motion the records were approved.

The President—The next business in order is the election of new members.

The following names were proposed by the Board of Directors:

Thomas A. Williams, Bangor Gas-Light Co., Me.

C. T. Frost, Rockland and Thomaston Gas Light Co., Maine.

George F. North, Augusta Gas-Light Co., Me.

Aaron Ackerman, Portsmouth Gas Light Co., N. H.

W. D. Cadwell, Nashua Gas-Light Co., N. H.

L. P. Kimpton, St. Albans Gas-Light Co., Vt.

W. H. Frost, Plymouth Gas Co., Mass.

George D. Bill, Malden and Melrose Gas-Light Co., Mass.

J. R. Todd, Natick Gas-Light Co., Mass.

A. W. Tarbell, Waltham Gas-Light Co., Mass.

On motion of Mr. Cabot the list was accepted.

The President—Is there any objection to any name on the list? There is no objection.

On motion the Secretary was instructed to deposit the ballot of the Association, and the gentlemen proposed were declared unanimously elected members of the Association.

The newly elected members having been introduced to the Association by the committee, took their seats.

The President—At the meeting of the Board of Directors this morning, it was voted that Joseph R. Thomas, Esq., engineer of the Williamsburg Gas-Light Co., of Brooklyn, N. Y., and President of the Society of Gas-Lighting of New York be proposed as an honorary member of this Association. Is it your pleasure that he be elected?

A vote was taken, and Joseph R. Thomas was unanimously elected an honorary member.

Mr. M. S. Greenough—The committee to invite gentlemen to seats would report that they have performed the duty assigned to them, and that all whom they have been able to find have been brought in.

The Preseident then introduced to the Association Mr. G. W. Edge, of Jersey City Gas-Light Co., an honorary member of this Association, who said: It gives me great pleasure to be present with you to-day, and to thank you collectively and individually for the honor which you have conferred upon me. I am clearly of an opinion that it can be from no advantage that you have derived from me in my experience of the gas business but from your desire and kind regard to give me a compliment.

Mr. Joseph R. Thomas upon being introduced said—I would like to thank you for the honor conferred upon myself in electing me an honorary member of your Association. It has always given me great pleasure to meet my New England friends. I am not much of a speaker, but I have been engaged so long in the gas business that I ought to be pretty well known. I can only thank you from the bottom of my heart.

The President (addressing the honorary members)—Gentlemen: It is with pleasure that I welcome you to our Association; and through me accept of the thanks of the Convention for honoring us to-day with your presence. I remember well, on entering into the gas fraternity, that the first names that reached my ears were those of Edge and Thomas; and I well know that the gas fraternities of New England and the United States are indebted to you for invaluable information that it has been your privilege to furnish them during the many and many years that you have so successfully managed the works under your charge. Our most earnest prayer is that the choicest of Heaven's blessings may rest upon you, and that you may long continue with us. In welcoming you to our Association to-day we hope it may be your pleasure to participate in its deliberations.

The Secretary—To save a little time, before the committee come in with their report, I will now present the treasurer's report.

The report of the treasurer, approved by the Auditing Committee was read, which was in brief as follows:

Received from annual assessments.....	$315.00
Disbursements.....	206.92
Balance in cash.....	$108 08
Permanent fund invested in two savings banks	$1000.00
Interest accrued and added.....	76.84
	$1076.84

It was accepted and ordered to be filed.

Letters were read from Charles Nettleton, of New York, secretary of the National Association, and others; also a telegram from Gen. Roome, one of the honorary members.

The President then delivered his annual address, as follows:

Gentlemen of the Association; Another year in its rapid flight brings us again in annual convention, and it affords me much pleasure to welcome so many, not only of our own members, but our friends and associates. And as we meet to-day, let us render thanks to the Giver of all Good, that we are permitted to assemble under such pleasant circumstances. Your presence here in such goodly numbers, and the interest manifested by the members in the objects and proceedings of our Association, affords us a permanent satisfaction; for we are assured that as we increase in years and numbers, as a compact and harmonious body, its sphere of usefulness becomes widened, its practical value increased, and the benefits to be derived will accrue not only to ourselves, but the public at large. At no former period in the history of our Association have its benefits or advantages been more apparent. Assembled as we are, with a common object, of individually and collectively imparting and receiving information in regard to the various processes we employ, and in the mechanical details connected with gas manufacture and distribution, and the general management of our works; guided and directed as we have been by the desire mutually to assist and inform each other, we have been enabled by the personal intercourse and interchange of thoughts, to produce results which have been permanent in their character, and lasting in their benefits. We are here to-day to congratulate ourselves upon the successful labors of the past, consider the present, and by a common and united effort commence the new year with renewed zeal and energy.

But while congratulating ourselves upon our prosperity and the increase in our members, we cannot fail to remember that two of our members have passed away, and "rest from their labors." At the semi-annual meeting in August a committee was appointed to take proper action thereon.

At our last annual meeting a committee was appointed to prepare a list of questions relating to the operations of the several companies under the charge of members of this Association They very promptly attended to the duty assigned them. and answers, I am happy to say, have very generally been returned, and the results will be laid before you at this meeting. In the list of questions proposed, I consider the committee exercised care and judgment. While there was much information which the committee desired to obtain, they did not wish to present any questions which could be considered as disclosing any of the private affairs of a company, as they were well aware that a prejudice had always existed in the minds of their associates against answering any questions of that nature. I hope the committee will be continued, for I believe when the members of the Association ascertain what an amount of information can be obtained from so few questions, they will readily consent to have the number increased, serving as the answers do, as guides to assist us to a higher standard of excellence; for the answers are not the opinions or theories of any man, but facts which are the results of practical workings, and are not to be made public under any circumstances. Objections have been made that some of the questions are not of importance, and others they are not able to answer, as their accounts are not arranged (for various reasons) in such a manner that accurate answers can be given. To such I would say all questions are important, as making the ground work from which other information may be obtained.

And if your manner of keeping your working accounts is not of that systematic character pursued by others, by which accurate data may be obtained, a knowledge that such a system is of practical advantage, we hope, may incite you to follow their worthy example, for the success of this Association must depend upon the information contributed by each member. And I much regret that none of our members have presented a paper in accordance with the vote of the Association, at its last annual meeting, "For the best original Desertation upon any subject connected with the Manufacture of Illuminating Gas from substances of which Coal is the principal ingredient," and for which the Association voted the sum of $50, and a further sum of $50 was added by our former president, Mr. Cabot. The subject is broad and comprehensive, and is worthy the attention of our members. And I sincerely hope at the next meeting we may have competitors for the prize. I well know that our members are practical men, and the increasing cares of our increasing business leave little time for scientific experiments.

Yet many of our members are daily placing upon record facts which, if properly arranged and presented to the Association, would be of much value; and in the general preparation of papers presented for our consideration, if they are short and to the point they are many times to us of more value than a long disertation. For the more concise a paper be made, if prepared with care and judgment, the more beneficial its results. The marked improvements which have been made in the means of manufacture, and in the general management of works within the past few years, and the results which have been obtained by some of our members, and the determination of gas engineers, not only of this country but of Europe, that nothing which bears the impress of improvement shall be allowed to remain untried, cheers us with the hope that we shall continue to march onward, steadily but surely decreasing the expense of manufacture, increasing the yield from coal, maintaining the candle value, and increasing the results from the sales of residual products, thereby enabling us to successfully compete with any process for the manufacture of gas, and our only competitor will be as a household work, and burning with a wick. For my belief is (which has never been shaken) that the future like the past, points in the direction of the manufacture of illuminating gas from coal.

The Committee upon Statistics have called my attention to Question 32. "How is the illuminating power of your gas obtained?" or in the words of the question—"How tested." And it appears to the committee that some action should be taken by the Association whereby a standard may be obtained for the illuminating value of our gas. Many of the companies have no bar photometer and rely upon the jet, which I find has not been brought to that state of perfection which will warrant its use as a standard.

The Sugg Illuminating Power Meter, I am informed by some who have it in use, has been found to be very reliable, although the price at which it can be procured, I fear will deprive us of the benefits which I think would accrue if it were in general use. But from the skill and energy which has been exhibited by our friends and co-workers in the mechanical departments of our work, I doubt not a means of determining the photometrical value of our gas will soon be produced, and one which can be adopted as a standard by all. The hope so kindly expressed by our first president, Mr. Greenough, in his able address, "That this the second meeting, is but the prelude to many others which shall be fraught with interest and instruction, and which, from the contributed experience of various departments of engineering, may remove or assist in removing the difficulties lying in the path of every member," I think has been fully realized. We enter to-day upon the eighth year of our Association's existence, and with an increased membership, embracing nearly all the gas engineers of our New England works; and I hope the day is not far distant when its advantages may be enjoyed by all, for the benefits to be derived from an Association of this character cannot be over-estimated; and I am happy to state that financially we are in a healthy condition, and the funds of the Association have been safely invested by the treasurer, and as the assessments are ample for the expences, I think we may, as an Association, safely undertake some important investigation, which as individuals, we could not attempt, and thereby increase its usefulness.

In closing I would thank the members of the Association for the uniform kindness and consideration they have manifested towards me during the past year. May the same harmony and good will attend our deliberations this day, as has prevailed in the past.

The Secretary—Before proceeding to the choice of officers it would be proper to call the roll.

The President read Article 12 of the Constitution.

The roll was called and fifty-two members answered to their names.

The President—There being a quorum present we will now proceed to the election of officers for the ensuing year. The usual method has been to appoint a committee to report a list of officers.

Mr. Lamson, of Boston—I move that the chair appoint a committee to nominate a list of officers for the ensuing year. Adopted.

The chair appointed Messrs. Rollins of Worcester, Harbison of Hartford, and Slater of Providence, as that committee.

The President—It has always been our custom at this time, in accordance with the wishes of the proprietors of the hotel, to take some action in regard to the banquet in the afternoon. Gentlemen, what action will you take?

The Secretary—As one of our honorary members, Gen. Roome, is not now with us, but expects to arrive about five o'clock, it may be well to have the dinner hour postponed to that time.

The President—Is it your pleasure that the Association dine together in its usual manner this day, the hour being fixed at five o'clock, to accommodate our honored guest, Gen. Roome, whom we hope to welcome at that time?

On motion of Mr. Dwight of Springfield, it was so voted.

The President—I will state that I hope all the members of the Association, and our invited guests also will endeavor to be with us at the banquet. The chair will appoint as the committee to make arrangements for the banquet, Messrs. Dwight of Springfield and Cushing of Lowell, who have served us in that capacity before, I think.

Mr. Dwight—I make a motion that our honorary members be cordially invited to partake of the banquet with us. The motion was adopted.

Mr. Armington—I have been for some time holding in my hand an envelope, which was given to me by the treasurer, and on opening it I find there is a check inside; but inasmuch as it is not payable to my order, and does not bear my name, perhaps somebody will volunteer to write his name upon it. The reason I hold this is, it will be remembered, that at our last meeting the society offered a premium of fifty dollars for the best desertation upon the manufacture of gas, and our President also offered fifty dollars in addition to the sum given by the Association. Unfortunately for us, no gentleman has responded to that invitation by presenting any dissertation. Consequently we are in pocket to the extent of that amount of funds, and we hold the check of our late President, which he gave us for this purpose. It has been my experience thus far, that whenever you wished to have a certain kind of essay prepared, and invited members to write upon any assigned subject, you would be almost sure to fail. But if you asked people to write volunteer essays upon any subject they pleased, you will be furnished with valuable essays quite freely. No gentleman, I think, who is capable of writing on this subject, feels like producing an essay here, when he knows that all these members have made up their minds to come here and criticise the paper which he is expected to produce upon the subject assigned. But if you let him write on any subject that he may choose himself, he will be sure to write. In returning this check to Mr. Cabot, late President of the Association, I move that the

thanks of the Association be presented to Mr. Cabot, for his very generous offer.

The motion was adopted.

REPORT OF COMMITTEE ON STATISTICS.

The Secretary—The committee appointed to procure statistics, directed me as secretary, to issue the questions, with the approval of the directors, according to the vote of the Association, and I have so done. They have been very generally answered—much more generally than I supposed they would be. The whole number of companies, or persons representing companies, to whom questions have been sent is sixty-seven. The number who have made returns is fifty-one. The number of those who have not made returns, including some of the members just elected, is sixteen.

Whole number of companies	67
Number who have made returns	51
Not made returns	16
Number of questions on each paper	34
Questions unanswered as follows:	
No. 4. Date of organization	1
" 8. Average number in use in twenty-four hours, etc.	1
" 10. Average weight of charge	2
" 12. Kind of condenser used	1
" 13. Kind of scrubbers or washers used	4
" 19 Maximum and minimum daily make	3
" 20. Quantity of gas made in year	2
" 26. Number of hours burning	2
" 29. Average night pressure	3
" 30. Average day pressure	1
" 31. Per cent of gas accounted for	5
" 32. Average illuminating power per year	12
" 33. How tested, how often, etc	10
Total	47

Questions 32 and 33 were those which, in the largest number of instances were unanswered, as you see. Some of the replies were very peculiar. For instance: "How tested?" "By State Inspector." "How often?" "Once a year."

I would say that in examining and tabulating these returns, and reading the comments made upon them, and the numerous communications addressed to me, I am satisfied that there is a difference of opinion about the way that the questions should be answered—as "Gas accounted for?" That is wrong; I can account for a great deal more gas than I have answered for—in the street lamps and in other ways. Of "The average illuminating power for the year?" the question should have been asked, "Where tested?" Some test at the works and some a mile or more from the works. Of course, if the committee is continued, new questions will be framed to meet those points.

I had the assistance of Mr. Slater, who ruled the first part of these tables, and who put the headings upon them. And then I had the assistance of Mr. Little, who happened to be in my office at a time I was feeling very unpleasantly, because I had not time to tabulate the returns in a proper manner, and he volunteered to do it. It is written off for your inspection upon this chart, which will be placed upon the wall, where you can all examine it. I had not time to prepare it in as finished a form as I should have liked to have done, because the returns came in so late. But, as secretary, and acting for the committee, I present this to the Association for their inspection and for their disposal.

The President—You hear the result of the doings of your committee. What action shall be taken? They have thus far completed the work for which they were appointed.

Mr. Lamson—I move that the secretary be authorized to employ some person as clerk, to make a careful and legible copy of the table, and that he keep it at his office at Charlestown, and that the members be allowed to call upon him at various times and examine it; and that that shall be the only copy made.

The President—Are the committee ready to report upon the list of officers for the ensuing year?

Mr. Harbison, of Hartford—I am instructed by the committee to report the following nominations:

President—Samuel G. Stiness.

Vice-Presidents—F. C. Sherman, L. P. Gerould.

Directors—John M. Hill, Wm. A. Stedman, Chas. D. Lamson, H. F. Coggshall, J. H. Rollins.

Secretary and Treasurer—George B Neal.

I am also instructed to say, sir, that the name of Col. Armington was left off of the Board of Direction, because the committee were in doubt as to whether he was now an honorary or an active member of the Association, as he does not reside in New England. The existence of that question of doubt in the minds of your committee is the only explanation for the leaving off his name, as the committee could only feel justified in reporting the names of active members.

Col. Armington—I trust that that list will be accepted. I am very much obliged to the committee for having left me off of the ticket. I declined last year the nomination, from the very fact that I could not be here to attend these meetings. I have been able to be here but once during the entire year.

Mr. Harbison—The nominating committee have ventured the suggestion that the Association ought to take some action upon this matter to-day, as to the position that active members who shall move out of New England, shall bear to the Association—whether they shall then be active or honorary members.

The President—The suggestion of the chairman may be very pertinent; but it is hardly in the province of the nominating committee to present the additional question. That may come up at another time. The chair will rule that it is not properly before us at the present time. We thank you for the suggestion, and in due time the matter will come up.

The question is upon the report of the committee on nominating officers.

Mr. Gibson moved that the report of the committee be accepted, and that the Convention proceed to a ballot. Adopted.

The President—Whom will you appoint to cast the ballot of the Association?

Mr. Harbison—I move that Mr. Greenough be appointed a committee to cast the ballot in behalf of this Association. Adopted.

Mr. Greenough advanced and cast the ballot, saying, "I take great pleasure in declaring that the officers proposed by the Nominating Committee have been unanimously elected.

The President—The ballot being unanimous in favor of the persons whose names are embodied in the report of the Committee on Nominations, I therefore declare them duly elected.

REMARKS OF THE PRESIDENT IN ACCEPTING THE ELECTION.

The President—I must thank you for this mark of your approbation in again electing me to the highest office in your gift, and the highest office which any gas engineer can desire to fill. The past year has been to me one of more than marked pleasure; for in my associating with the gas fraternity of New England, and of other parts of the United States, I have been greeted with a welcome and cordiality that was most gratifying, and not only by our own members, but by friends outside of our organization. The warm grasp of the hand with which I have been greeted, and the generous hospitality with which I have been welcomed, has made a deep and lasting impression upon my mind, for which I most sincerely thank you all. And I cannot allow this occasion to pass without returning my thanks to the officers of the Manhattan and New York Gas-Light Companies of New York, for the very kind invitation which I received from them, to unite in doing honor to that distinguished engineer, William King, of Liverpool. That we were received with a munificent hospitality by the companies I need hardly state. The ceremonies were worthy of the occasion, and to those gentlemen, for their kind and personal attentions to me, I am deeply grateful. We will now proceed with the usual business of the Association.

REMARKS OF THE SECRETARY IN ACCEPTING THE ELECTION.

As you, Mr. President, at the head of the list, have made your little speech, I think that I who occupy the very lowest place on the list of officers as secretary and treasurer, may also thank the gentlemen present for conferring so great a favor upon me. Although much labor has been thrown upon me for the next year, I will say that I am ready to act as your secretary and treasurer without any reward except the consciousness that I am doing a good work, and doing it for no pecuniary reward. It is rather a pleasant duty, although it occupies a great deal of time. The correspondence which the secretary has to carry on with persons interested in our specialty is quite extensive; the giving attention to the issuing of these many questions, and receiving and tabulating the answers thereto, occupies much time; but I am ready to do my best. I have attempted to discharge the duty which you have imposed upon me, faithfully for the several years that I have been in office. I was appointed your first secretary and treasurer, and have held that office ever since, during a period of seven years. But I do not wish to monopolize these offices. If gentlemen wish me to do so, I am ready to retire at any time.

Ex-President W. W. Greenough coming into the room, was invited to an honorary seat with the officers of the Convention.

Mr. Dwight—The committee appointed to make arrangements for the banquet have attended to that duty, and it has been arranged that we shall meet together at 5 o'clock. I hope there will be a full attendance.

The President—I hope as many as can make it convenidnt will be present at that time.

A long discussion followed upon the motion of Mr. Lamson, during which several motions were made and several amendments were proposed, but finally the following votes were passed nearly unanimously.

Voted—That any member who has made his returns of statistics to the secretary, may withdraw the same if he desires to do so.

Voted—That the secretary be hereby authorized and directed to cause a suitable number of copies of the "Table of Statistics" to be printed and sent to each member of the Association, except to those who have made no returns, or having made such returns shall withdraw the same.

Mr. Hill offered a resolution that any member of this Association who removes from the New England States, be retired from the active list, if he chooses it—not otherwise. With some discussion the motion was withdrawn.

The President—There is no matter of business before the Association at this time. It has been proposed that we take a recess from half past two until three o'clock.

Mr. Cabot—I wish to say to the members of the Association, that I have brought with me a section of a purifier screen or tray that we have been using for the last six months, in the Lawrence Gas Works. I thought, perhaps, some of you gentlemen might like to see it. It is an economical tray and we think a very desirable one; one that can be made by any common mechanic. There is no patent on it. I would like to have you look at it during the recess, and if you wish to use it you can do so freely.

The President—The holders of the Electric Street-Lighting Apparatus desire to exhibit a specimen of their apparatus to you in this room, at 3 o'clock, at which time it is desired that the Convention shall be in session. If you so determine we will now take a recess until 3 o'clock.

A recess was then taken.

[To be continued.]

An Act Regulating Gas Works in the District of Columbia.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that from and after the thirtieth day of June, eighteen hundred and seventy-four, the illuminating power of the gas furnished by any gas-light company, person, or persons, in the District of Columbia, shall be equal to sixteen candles by the Bunsen photometer, using the English parliamentary standard Argand-burner, having fifteen holes and a seven-inch chimney, consuming five cubic feet of gas per hour, and such gas shall not contain more than twenty grains of sulphur in any form in one hundred cubic feet, nor more than five grains of ammonia in any form in one hundred cubic feet. When the illuminating gas supplied by any company, person, or persons in the District of Columbia, shall at any one time be of less illuminating power or of less purity than according to the standard just heretofore given, it shall be so reported by the inspector of gas and meters to the company, person, or persons supplying the same, who shall be subject to a penalty of one hundred dollars, to be recovered before the proper tribunal and paid into the treasury of the District of Columbia aforesaid, for each and every day during which such violation shall continue: *Provided, however*, That if it shall appear that such deviation from the above-named standards could not have been prevented by ordinary care and prudence, but was occasioned by some unavoidable cause, then the said penalty shall not be enforced

Sec. 2. That a suitable and impartial person, competent as a chemist, who is not a stockholder or employee in any gas-works, shall be appointed by the President of the United States, by and with the advice and consent of the Senate, to be designated and known as inspector of gas and meters, whose compensation shall be a salary of two thousand dollars per annum, and whose duties shall be to test and determine the illuminating power and purity of the gas furnished by any company, person, or persons in the District of Columbia; and to test, prove, and seal all meters that may hereafter be used by them; and that a suitable person, who shall be a gas-fitter by trade, shall be appointed by the President, as aforesaid, on the recommendation of the inspector of gas and meters, as an assistant inspector, at a salary of one thousand dollars per annum, who shall assist in the duties specified under the direction of the inspector of gas and meters.

Sec. 3. That a laboratory shall be provided and fitted up by the Washington gas-light company, subject to the approval of the inspector, in the central part of the city of Washington, at a distance as near as may be, of two thousand feet from any gas-works, and furnished with suitable apparatus for the transaction of the business of the inspector and assistant inspector, for which it is intended, and the laboratory shall be kept open on all business days between the hours of eight o'clock in the forenoon and five o'clock in the afternoon: *Provided*, That the cost of fitting up said laboratory shall be paid for by each gas company in the District of Columbia in proportion to their sale of gas for the year eighteen hundred and seventy-three.

Sec. 4. That the company, person, or persons furnishing the gas may, if they see fit, on each occasion of the testing of the gas by the inspector or assistant inspector, be represented by some officer, but such officer shall not interfere in the testing.

Sec. 5. That daily inspection, Sundays excepted, shall be made in conformity to the intent of this act between the hours of five and eleven o'clock in the afternoon, and a record shall be kept of each inspection, giving the illuminating power and purity, which shall be open to the public, and a copy of the daily inspection shall be furnished the following day to the company, person, or persons furnishing the gas, Saturday's inspection to be furnished on Monday, and a full report for the month to be furnished, upon request, to any daily paper printed in the city of Washington on the day of their publication, next after the twenty-fourth day of each month, to include each day's test from the date of previous publication, and giving the average illuminating power for the month.

Sec. 6. That all bills for gas furnished by any company, person, or persons, shall state the average illuminating power for the month; and if the same shall fall below sixteen candles, as in this act prescribed, then the amount of the bill shall be reduced pro rata.

Sec. 7. That in testing meters, the inspector or assistant inspector shall ascertain whether the meter is of proper construction, and requires only the pressure of a column of water indicated by the water-gauge, commonly used for such tests, of one-fourth of an inch high to work it, and whether it works regularly and correctly, and registers exactly the amount of gas passing through it, first, at the rate the meter is marked to supply; secondly, at one-third its rate; thirdly, at twice its rate. The standard foot shall be one cubic foot, containing sixty-two and three hundred and twenty-one one-thousandths pounds, avoirdupois weight, of distilled water at the temperature of sixty-two degrees Fahrenheit, and with a barometrical pressure of thirty inches; and meters registering within two per centum either way of the exact number of such feet passing through them at the first named rate, and within three per centum at the second and third rates, and no others shall be deemed accurate and be stamped by the inspector. The inspector shall keep at the laboratory a correct record of all meters inspected by him, with their proof at the time of inspection, which record shall be open at all times to the public for any reasonable examination by any company, person, or persons having any interest therein.

Sec. 8. That any gas meters now in use shall be proved and tested on the written request of the consumer of gas on whose premises it may be, and in his presence, if he requires, upon the payment in advance to the inspector or assistant inspector of fifty cents for each and every meter inspected, proved, and sealed, and if any such meter, on being tested, shall be found to register inaccurately to the injury of the consumer to an extent exceeding two per centum, the fee of fifty cents shall be returned to the person applying for said inspection and be paid to the inspector by the company, person, or persons supplying the gas; and every such meter shall be considered correct, and sealed accordingly, which shall register quantities varying from the true standard measure of gas of not more than two per centum, and a record shall be kept of the same and of all fees so collected. And all meters hereafter used by any gas company, person, or persons shall be first inspected, proved, and sealed at the laboratory provided for by this act; and for such inspection, proving, and sealing the company, in the first instance, and thereafter the company, person, or persons applying to have the meter inspected, shall pay fifty cents for each meter, a record of which shall be kept and of the fees so collected; and all fees shall be applied to the payment of the expenses for maintaining and keeping in good order and repair the laboratory and apparatus.

Sec. 9. That each company, person, or persons manufacturing illuminating gas in the District of Columbia, shall, when required, in writing by the inspector of gas and meters, bring to the laboratory any meter that may have been required to be inspected, proved, and sealed, and to return the same to its proper place after such inspection: and it shall not be lawful for any other party or person to remove and return meters.

Sec. 10. That the inspector and assistant inspector of gas and meters shall each give bonds to the extent of double his annual salary, and shall each take an oath or affirmation, before some officer legally qualified to administer the same, that he will faithfully, diligently, and impartially discharge the duties of his office.

Sec. 11. That the Washington gas-light company shall be authorized, on and after the passage of this act, to charge and receive for illuminating gas furnished to and paid for by the Government of the United States, at the rate of two dollars per one thousand cubic feet; and when furnished and paid for by other parties; or by the inhabitants of the city of Washington, at the rate of two dollars per one thousand cubic feet: *Provided*, That if the party or inhabitants so furnished shall pay monthly any bill within seven days after the same shall have been presented, said party shall be entitled to a discount upon the amount of such bill at the rate of twenty-five cents per one thousand cubic feet. And all laws authorizing any higher rates are hereby repealed: *Provided*, That when the price of gas coals delivered at the works of the Washington gas light company shall advance to eight dollars and fifty cents per ton, the price of gas to consumers may be advanced ten cents per thousand cubic feet and an additional ten cents per thousand feet for each additional dollar per ton that gas coals may advance in price and in like manner a reduction of ten cents per thousand feet shall be made for each and every dollar per ton that gas coals may fall in price below seven dollars per ton. And for that purpose the Washington gas-light company shall in the month of May in each year furnish the Secretary of the Interior with a statement of all their coal contracts or purchases for the ensuing year excepting the Ritchie mineral and the Richmond coal, the cost of which shall not enter into any calculation in making an average, which statement shall be sworn to before a justice of the Peace by their engineer and secretary, and the advance or reduction of price shall take place on the first of July ensuing.

Sec. 12. That the Washington gas-light company shall be authorized and required to furnish illuminating gas to the government of the District of Columbia within the distance of fifty yards from any of their mains on the same terms as to the Government of the United States, and in case of the non-payment of any monthly bills by the said District beyond the period of ten days from the time of presentation, the company shall be entitled to demand and receive interest thereon from date until paid. And the said company shall light, extinguish, keep clean, and repair the Washington city street lamps at the uniform price of forty dollars for each lamp per annum, to burn two thousand two hundred hours per annum, with a six-foot burner on each lamp, subject to any regulation that may be prescribed by the city authorities as to the time of lighting and extinguishing the same, and any extra number of hours to be charged and paid for at the same ratio: *Provided*, That the city of Washington shall furnish, when necessary, new lanterns to replace old ones, and shall furnish and pay for the reasonable expense of erecting new lamp-posts to replace such as are old, damaged, and unfit for use.

Sec. 13. That if any person or persons, supplied with gas, neglect or refuse to pay the amount due for the same, such company may stop the gas from entering the premises of such person or persons. In no case shall the officers, servants, or workmen of the company remove a meter from premises supplied by the company, unless by consent of the consumer, without at first giving 48 hours' notice in writing by leaving the same at the premises of the consumer; and said removal shall take place only between the hours of eight o'clock in the forenoon and two o'clock in the afternoon.

Sec. 14. That it shall be lawful for Congress at any time hereafter to alter, amend, or repeal this act, and all acts and parts of acts inconsistent herewith are hereby repealed.

Sec. 15. That any person who, with intent to injure or defraud any gas company in the District of Columbia, shall make or cause to be made any pipe, tube, or other instrument or contrivance, or connect

the same, or cause it to be connected with any main-service pipe or other pipe for conducting or supplying illuminating gas in such manner as to connect with and be calculated to supply illuminating gas to any burner or orifice by which illuminating gas is consumed, around or without passing through the meter provided for the measuring and registering of the quantity of gas there consumed, shall be deemed guilty of a misdemeanor, and upon conviction shall be punished by imprisonment not exceeding six months, or by fine not exceeding two hundred and fifty dollars.

SEC. 16. That the price which may be charged for gas by any gas-light company in the District of Columbia shall be uniform and the same to all consumers, and any reduction made in the price or cost to any person or persons, except to officers of the company, shall furnish a legal right on the part of any other person or persons to demand gas at the same cost or price.

Approved, June 23, 1874.

GAS-LIGHT COMPANIES IN WASHINGTON CITY.

FEBRUARY 18, 1878.—Laid on the table and ordered to be printed.

Mr. Bouck, from the Committee for the District of Columbia, submitted the following report:

[To accompany bills H R. 924, 1368, 1527, 1705.]

The Committee for the District of Columbia, to whom were referred House bills Nos. 924, 1268, 1527 and 1705, all relating to the organization of gas-light companies in the city of Washington, report as follows:

That House bills Nos. 924, 1368, and 1705 are bills to incorporate companies, and House bill No. 1527 is a general law upon the subject.

The committee are of the opinion that in the furnishing of illuminating gas in the city of Washington, the United States, the District of Columbia, and the people of said District have common interests, to wit, good and cheap illuminating gas. The price of such gas depends upon the cost of construction and maintenance of gas works and the appurtenances, and the amount of gas consumed. Two gas works would double the cost without any increase of consumption of gas. The construction of new gas works necessitate the tearing up of sidewalks and the streets at the crossings.

A law authorizing other parties to construct gas-works is liable to abuse and do great public injury, in this, in forcing the present company to buy them off, and thereby necessarily increasing its capital stock or liabilities, and thereby increasing the price which the said company would be reasonably justifiable in charging for gas.

For the above reasons, the committee are of the opinion that authority should *not* be given to any other person, company, or corporation to erect and maintain gas works in the city of Washington, unless there exists an imperative necessity therefor.

That there is no necessity therefor is apparent, because the United States by law has the right (and has asserted such right), and which right the Washington Gas Light Company recognizes, not only to fix the quality of the gas furnished by said company, but also its price, and to make such regulations for the government of said company as may be necessary to protect the United States, the District of Columbia, and the people thereof.

There is now an act of Congress regulating the Washington Gas-Light Company, not only as to the quality of the gas furnished, but the price to be paid therefor, and for inspections, etc. The provisions thereof are as guarded and stringent as can be found in the law of any state.

There is a bill now pending in this House to reduce the price to be paid said company for gas furnished.

For the aforesaid reasons the committee recommend that neither one of the aforesaid bills do pass.

Gas-Light Intelligence.

OUR EXCHANGES.

[*From Engineering News.*]

United States.

PRICE OF GAS AT ST. CATHERINE'S.—The price of gas in St. Catherine, Ont., is reduced from $2.80 to $2.50 per thousand feet.

USE OF CALCIUM LIGHTS.—The use of calcium lights in searching the ruins of burned buildings has been introduced into the New York Fire Department.

ELECTRIC STREET LIGHTING.—Baltimore is considering the feasibility of lighting her street-lamps with electricity, by which it is claimed a clear annual saving of $34,000 will be effected.

ST. JOSEPH, MO., WITHOUT GAS.—St. Joe, Mo., is without gas—illuminating gas—and the result bids fair to involve the city in a suit for damages with a commercial runner who fell down in the dark and broke a plank in the sidewalk with his cheek.

OIL AS FUEL.—A Russian correspondent of *Engineering* (London) states that on the river Volga, many steamers have been using as fuel, crude petroleum, also kerosene refuse for their main boilers. The economy is stated to be considerable as compared with wood.

ENLARGEMENT OF MILWAUKEE GAS WORKS.—The Gas-Light Co. in Milwaukee, are about to improve and enlarge their works, adapting them to the prospective demands of the city for years to come. A new and large holder is to be built, and a twenty-four inch main laid under the river to better supply the West side. This main will be laid in a dredged cut, in three sections, without interference with navigation.

[*From the Coal Trade Journal.*]

PRICE OF GAS IN BALTIMORE.—The Gas-Light Co. of Baltimore (the old company) reduced the price of gas to $1.50 per thousand.

A LARGE CARGO OF GAS COAL.—The schooner "Dreadnought" sailed from Richmond, Va., on the 28th ultimo, laden with 733 tons Cannelton Cannel, for New York, being the largest cargo of coal ever shipped from Richmond. She was loaded by the Cannelton Coal Co. in twenty-four hours.

[*From the Pittsburgh Chronicle.*]

NO PURCHASE—THE VOTE ON GAS IN ALLEGHENY—HOW THE TAXPAYERS DECIDED THE QUESTION SUBMITTED TO THEM.—The scheme in Allegheny to purchase the gas works did not meet with the success the interested members of Councils anticipated. The members of the two branches of that body who boasted that the Councils were unanimously in favor of the purchase, will discover that they are the misrepresentatives of the people, and that intelligent constituents do not propose to submit any longer to extravagant management in the affairs of the city. The returns on the gas question are not all in, but from the vote at hand it is shown that the project to purchase the works was overwhelmingly defeated. The CHRONICLE opposed the scheme, because it opposed a further increase of the bonded indebtedness of Allegheny, contending that the interest on the bonds would add to the tax levied by the city. As a further ground of opposition it may be stated that the officials, under the city, in case the works were purchased, had already been agreed upon, and even subordinates had been promised positions if the scheme should meet the approval of citizens. In addition to these arguments the CHRONICLE pointed out the fact that there were no real grounds for complaining against a monopoly for the reason that oil is cheaper than gas, and that if the use of this fluid is not convenient or desirable, the numerous methods of converting naphtha, benzine, and other products into gas, at from thirty cents to one dollar per thousand cubic feet, gave every resident of the city an opportunity to escape unjust charges for illuminating purposes. As an evidence of the effect of the arguments used, we take pleasure in giving the following returns of the vote cast yesterday for and against the purchase of the works:

Wards.	For.	Against.
First ward, first district	...	...
First ward, second district	13	94
First ward, third district	10	118
Second ward, first district	15	102
Second ward, second district	50	283
Second ward, third district	14	181
Second ward, fourth district	10	161
Third ward, first district	21	75
Third ward, second district	47	96
Third ward, third district	82	84
Third ward, fourth district	32	158
Fourth ward, first district	21	184
Fourth ward, second district	21	194
Fourth ward, third district	15	158
Fourth ward, fourth district	25	184
Fifth word, first district	...	...
Fifth ward, second district	...	...
Fifth ward, third district	26	117
Sixth ward, first district	17	237
Sixth ward, second district	14	149
Sixth ward, third district	7	154
Seventh ward	12	264
Eighth ward, first district	20	149
Eighth ward, second district	3	89
Ninth ward	7	112
Tenth ward, first district	..	43
Tenth ward, second district	6	54
Eleventh ward	2	191
Twelfth ward, first district	14	56
Twelfth ward, second district	4	38
Thirteenth ward	29	101
	506	3,571

The Curious Facts About Gas.

Whether or not the use of olefiant gas as an illuminating agent tends directly to superinduce a state of mental imbecility we are not prepared to say, with a tolerable measure of confidence. Granting that it will not do to assume that one thing is the cause of another because the two are frequently found in company, we nevertheless note the well nigh juxtaposition of any two things as tending at least to suggest the relation of cause and effect.

Meaning to assert no more than this, we wonder that no curious investigator of mental phenomena has thought of collecting the facts about gas, which would make a very curious chapter if set in orderly array. His point of departure, of course, would be the manifestly insane tendency of all human beings who use gas to reduce their supply of light in the hope of thereby reducing the cost of their light. We call this a manifestly insane tendency, because it is a direct attempt to subvert a law known to be as persistent as the law of gravitation itself. Every person who ever had gas to pay for knows experimentally that the less gas he burns the more gas he must pay for. It is not easy to explain this, but experience teaches it—not the experience of one man, but the uniform and universal experience of householders. Yet in practice we fly in the face of this law constantly. When a gas bill which was expected to be for four dollars appears in the house through the aperture under the basement door, and the good housewife finds that it amounts to seven dollars, she straightway institutes a system of supervision which shall diminish the consumption of gas in the house one half. She reduces the number of burners employed and forbids the full use of any of them. She follows the careless members of the family about the house, turning down every burner not immediately needed, until it shows only a blue point of flame, insufficient to light her feet out of the room. She compels the members of the household to feel their way about, as ferryboats do in a fog, and gives them a chance to study the nature of the sense of feeling by

means of experimental investigation with their shins. It is certain that she thus reduces the amount of gas consumed to one half the amount used the month before; and it is equally certain that the bill at the end of the month will be increased to a similar proportion.

Curiously enough, nobody learns by experience of this sort. Month after month the lessons of experience are defied. Everybody knows that the rule is a fixed one—the less gas burned the greater the cost will be—and yet everybody persists in trying to reduce gas bills by sparing the gas. Logically the right course would be to light all the burners in one's house and keep them burning as nearly all the time as possible.

The late Bishop Whitehouse, of Illinois, made some curious experiments on this subject several years ago. Having discovered the fact referred to, that the less gas he burned the more he was required to pay for it, he determined to subject the law which appeared to govern the phenomena of gas consumption to a severe scientific test. He carefully shut the gas off the meter in his house, had a carpenter accurately fasten all the doors and windows, and went to England to attend the Pan Anglican Council. When he returned the official reader of meters visited him and inspected the dials in his cellar. Then came the bill, and the law was firmly established, for the good bishop was charged for a third more gas a month during the time of his absence than he had ever been asked to pay for before.

It is a curious set of phenomena which here invite investigation, and we thus briefly refer to them in the hope that we may stimulate some scientific inquirer to resolve and explain them.—*N. Y. Evening Post, March* 11.

Terrific Gas Explosion.

TWO PERSONS INSTANTLY KILLED AND SEVERAL VERY DANGEROUSLY INJURED—A TOWN HALL WRECKED AND FIRED.

[By Telegraph to the Herald.]

CINCINNATI, OHIO, March 5, 1878.

The little village of Harrison, on the western edge of this county, was the scene of a frightful gas explosion last night, riddling the new Town Hall, killing two or three people and injuring a number of others. The building was entirely new, having been completed only a few months, and was intended for public use entirely. The first floor had the Post office, Mayor's office, and a room for a fire engine; while the second floor was fitted for a public hall. The building was lighted by gas generated from gasoline, the machine being known as the Van Kaller or Cincinnati Machine. It had not worked well ever since it was put in two months ago, and an agent of the manufacturer had been working to find out the difficulty. Last evening, when he left he put a man named Rapp, a Councilman of the village, in charge.

About 8 o'clock Rapp, accompanied by Councilmen Fisher and Probst, entered the cellar for the purpose of making some alteration in the machinery, it is supposed. They had been there but a moment when the catastrophe occurred. The explosion was terrific. The building seemed to rise in the air and then in a moment fall to pieces. The Post office was filled with people who had come to get their mail from the train that had just arrived. Then, to add to the horror, the building at once took fire. A panic ensued that was terrible. Those who were able to get out rushed forth, wild with terror, while the people on the streets attracted by the cries of those within the building, hurried in to rescue them.

Rapp, it is supposed, was instantly killed, his body being found afterward, with all the clothes burned off, where he had been standing.

A ten-year-old girl named Katie Ohmer, who was in the room above, was caught between two sections of floor as they came down and suspended, head downward, in the flames that filled the cellar, being literally roasted to death.

Probst and Fisher, who were in the cellar at the time, were blown across the room, escaping through the doorway with their clothes in flames. Alexander Wescott and L. Parker were dangerously burned. A Miss Hallowells and Alexander Wescott will hardly recover. Granville Yeager, C. Popham, Alexander White, and Postmaster Harwood are quite seriously injured.

The building was badly wrecked by the explosion, and the fire destroyed most of the interior, not being put out for some little time.—*N. Y. Herald, Mar.* 10.

Condition of Industry and Business in Massachusetts.

The Boston *Commercial Bulletin* says—

The Bureau of Statistics of Labor has done a very valuable work recently, by making a careful and extensive inquiry into the actual condition of business in Massachusetts. There has been a great amount of encouraging talk during the last few months about the revival of business, but there have also been croakers who have persistently denied that there has been any improvement whatever. We have been among the first-mentioned class, never among the croakers. We have not spoken at random during the past year in expressing the opinion that business was steadily improving, but have said it after seeking in every practicable way to ascertain the actual condition of our manufacturing interests.

It is specially gratifying to have, at the opening of the year, an official assurance that those who have seen an improvement during 1877 did not draw upon their imaginations for the view. The bureau has just completed an investigation as to the condition of Massachusetts manufactures, a summary of which is presented in Gov. Rice's able inaugural address. While further details will be awaited with interest, this summary will receive attention for the facts it presents and as proof that the bureau recognizes the demand for practical service, and is determined to be of value to the people.

Returns were received from cities and towns producing 86 per cent. of the whole products of the State, affording means for comparison of the condition of our large industries in 1877 with that of 1875. There has been a decrease, on an average, of about nine per cent. in the wages paid, but an increase in working time in days. The paper trade shows an increase of nineteen days over the working time in 1875; the manufacture of worsted goods twenty-seven days; and in the manufacture of cordage, cotton goods, carriages, straw goods, carpetings and wool hats, an increase of working time has been made, while in boots and shoes, leather and agricultural implements, there has been neither increase nor decrease. In the manufacture of machinery, whips, musical instruments, and woolen goods, a slight decrease in working time is reported.

The great industries of carpetings, paper, woolen goods, worsted goods, cigars, boots and shoes, cotton goods, leather and metallic goods, report an increase in the number of hands employed, ranging from one to thirty-five per cent. over the number in 1875; while a few of the establishments report a falling off in the number of persons employed.

On a gold basis, the value of products from the manufacture of hats, carpetings, straw goods, cordage, paper, worsted goods, whips, cigars, boots and shoes, cotton goods, leather, musical instruments and metallic goods, has increased from five per cent. to thirty-six per cent. over the products of 1875; while but few industries show a falling off. In nearly all there has been an increase in the quantity of goods made; but depreciation in prices, in some instances, makes the value of products less than in 1875.—*Iron Age.*

Prices of Gas Coal.

With the exception of some small additional sales of Westmoreland and Penn coal for New York, we have nothing new to report in connection with domestic coals. Continued shipment of Provincial and Newcastle are noted. The announcement of prices of Westmoreland and Penn for Sound ports, on the bases of $5.75 delivered, has not yet led to contracts. Prices for ports east of Cape Cod not yet fixed. The combination of last year did not succeed in compelling purchasers in New England to confine themselves to the coals allotted to them by the Pennsylvania and Baltimore and Ohio Railrood, and it must be clear to all parties to it, that if the schedule of 1877 is continued, a further falling off in the sales of domestic coal must result.

We are advised that the Montreal and Quebec Gas Companies have contracted for a part of their supplies for 1878 from Newcastle at about $3.00 gold, delivered at the port named—a remarkably low price—illustrating the competition which the Provincial coals meet with in their own markets, from the cheapness of ocean freight, the remunerative grain freight from Montreal attracting the surplus steam tonnage now lying idle in Europe.

We continue our last quotations for some of the leading coals, viz.:

Despard	5.35	
Marion	5.35	
Murphy Run	5.35	
Newburgh Orrel	5.35	
Ches. and Ohio RR. Caking Coal	5.40	($4.10 f. o. b. at Richmond.
Block House	4.50	1.75
Glace Bay	4.25	1.60 Gold f. o. b. at Mines.
International	4.25	1.60
Clover Hill	4.00	
Cannelton Cannel	10 00	
Peytona	10.00	

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.

(with W B Scott & Co.,)

24 PINE STREET, NEW YORK CITY.

MARCH 16, 1878

☞ All communications will receive particular attention

Gas. Co.'s of N. Y. City.

	Capital.	*Par.*	*Bid.*	*Asked.*
Central, Westchester	466,000	50	85	90
Harlem	$1,850,000	50	90	95x
Manhattan	4,000,000	50	200	204
Metropolitan	2,500,000	100	130	133
" Scrip	$1,000,000	...	100	103
" Bonds	500,000	1000	92½	95
Mutual	5,000,000	100	75	80
" Bonds, gold.	900.000	1000	—	105
Municipal	1,000,000	100	90	97
New York	4,000,000	100	118	120
Suburban, W'steh'str	390,000	50	—	100
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	155	160
Citizens	1,200,000	20	80	85
" Scrip	320,000	1000	95	97½
Peoples	2,000,000	10	20	40
" Bonds	$ 325,000	...	--	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	65	70
Nassau	1,000,000	25	--	78
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	100	110
" Scrip		...	95	97
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	80	90
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md	2,000,000	100	134	134
" Ctfs., gold	1,000,000		106	110
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	109	110
" " Bds.	124,000	—	105	107
Cincinnati G & C Co				190
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	132	---

NEWCASTLE AND PROVINCIAL GAS COALS.

THE UNDERSIGNED ARE PREPARED TO EXECUTE ORDERS FOR

NEWCASTLE COAL (NEW PELTON),

ALSO FOR THE BEST QUALITIES OF

PROVINCIAL GAS COAL,

DELIVERED AT ANY PORT IN THE UNITED STATES.

We supplied nearly 100,000 tons of Provincial Coal to some twenty-five different Gas Companies in 1877. These coals will yield in practical use fully

10,000 Cubic Feet of 16 1-2 Candle Gas---40 Bushels Coke.

91 STATE STREET, BOSTON. **PERKINS & JOB.** 27 SOUTH STREET, NEW YORK.

Fort Wayne, Ind.....		100	...	—
Hannibal, Mo.....	100,000	100	95	100
Hartford, Conn.....	700,000	25	184	186
Hempstead, L I.....	25,000	100	...	—
Jersey City	386,000	20	155	160
Jamaica, L. I.....	25,000	100	...	—
Jacksonville, Ill.....	120,000	50	82	...
Lewistown Maine...	400,000	100	70	80
Lima, Ohio,.....	60,000	100	—	...
Bonds	30,000		90	
Laclede, St Louis Mo.	1,200,000	100	100	110
Long Branch.....		20	40	50
Peoples, Jersey City		...	120	125
Peoples of Albany...	650,000	100	–	27
" Bonds	350,000	1000	—	-
Peoples of Baltimore		25	—	56
" Bonds....			106	—
Plainfield, N. J.....	80,000	100	—	105
Perth Amboy		25	—	95
Rochester. N. Y.....		100	50	60
Woonsocket, R. I....	150,000	100	100	...
Halifax N. S.....	400,000	40	148	150
Hamilton, Ontario...	150,000	40	117½	
San Francisco Gas-Co., S. Fr'isco Cal.			93	94
St. Louis, Missouri..	600,000	50	73	75
Stillwater, Minn.....	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
Troy, Citizens.....	600,000	100	—	60
Toledo, Ohio.....			95	97
Washington, D. C..		20	240	250

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A Gas Engineer of long Experience, wishes to rent a Gas Works in the United States, or Canada. Proprietors and Companies of all size Works (large one preferred) that wish to Lease for a term of years, please write and state consumption per day, cost of coal per ton delivered, number of feet per ton, price of coke, price of gas per 1000 cubic feet, number of public lamps, and their price yearly. Also, how old the Works are, and all other information they may think proper to give. Please address J. A. M., P. O Box 9097, New York. 459-4t

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in England and this country, the management of a small Gas Works, or the position of Superintendent of a large one. Has been five years in the Works where now employed. Can give good recommendations. Address J. F., office of this Journal. 459-1t

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GAS SCREEN,

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Manufactory at Haverhill, Mass.

W. H. FRENCH, Agent,

Formerly with AMERICAN GAS SCREEN CO.,

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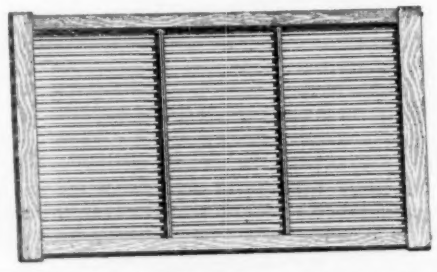

The Screen is made with an ash or oak frame, perforated with ROUND RATTANS, turned and reeved through, drawing the frame firmly together, strengthening it *without the use of nails or rivets.*

This Screen is reversable, can be used either side up, gives a large purifying capacity; there is no clogging by foul lime, as the rattan presents a smooth surface and can be cleaned very easily. It is considered by all Gas Engineers who have used it to be the best Screen now in use.

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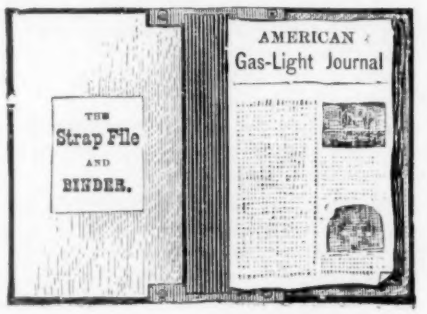

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IMPROVED RETORT SETTINGS.

Selections from last season's Testimonials, from Small, Medium-sized and Large Gas Works.

FORT HOPE GAS-LIGHT COMPANY,
FORT HOPE, CANADA, March 5, 1877.

E. S. CATHELS, ESQ.

Dear Sir: The settings of three iron retorts which I obtained from you in 1875, has more than realized our expectations, and has been so satisfactory as to leave nothing to be desired in the way of improvement on it. We have no difficulty whatever in attaining any desired heat, while the consumption of coke is very small, not half of that of our former setting. We have now been working the first setting about twelve months, and it will last some time yet. We have also adapted the same principle to a setting of two irons, with equally satisfactory results. In the summer months with our old plan, the coke produced was not sufficient for firing, and we had in addition to use coal. Last summer we saved and sold a large quantity of coke.

Yours faithfully,
(Signed) GEORGE M. FURBY, Manager and Secretary.

GAS WORKS, CHARLESTOWN, P. E. I., March 8, 1877.

E. S. CATHELS, ESQ.

Dear Sir: Yours of the 2nd inst. to hand and contents noted. In reply I beg to say that I set a bench of five retorts last summer upon your plan. They have been working up to the present time, and have given such satisfaction that I shall in future set on the same plan.

Yours truly,
(Signed) WILLIAM MURPHY, Manager.

OFFICE OF THE CINCINNATI GAS-LIGHT AND COKE COMPANY,
CINCINNATI, March 8, 1877.

E. S. CATHELS, ESQ.

Dear Sir: Yours of 2nd inst. received, and in reply state that we have one house—34 benches—of your three chambered, seven retort settings, which have given entire satisfaction. Respectfully,
(Signed) A. A. HICKENLOOPER, V. P.

GAS WORKS, MEDINA, N. J., March 10, 1877.

MR. E. S. CATHELS.

Dear Sir: In reply to your enquiry as to the working of your setting, I have pleasure in testifying that I have not seen better or more uniform heats in an experience of twenty-five years, and there is little fuel required.

Yours truly,
(Signed) J. FINDLAY.

LISBURN GAS-LIGHT COMPANY, LIMITED,
LISBURN (IRELAND), March 20, 1877.

E. S. CATHELS, ESQ., Montreal.

Dear Sir: In reply to yours I have now four beds of six retorts set on your plan, which have given me great satisfaction, with no difficulty in obtaining good heats. My make for the last nine months has been 9,760 feet per ton of coal, and there is more coke for sale than formerly. Yours respectfully,
(Signed) EDWARD STEARS, Manager.

GAS WORKS, APELDOORN (HOLLAND), March 28, 1877.

MR. E. S. CATHELS, MONTREAL.

Dear Sir: I am in possession of your letter of the 2nd inst., and in reply I can certify that I have been working during seven months with the oven with two retorts constructed upon your principle, and am highly satisfied with the results. The fuel account has been much less than before, and the retorts are equally and sufficiently heated.

As I don't have a station meter I cannot give the exact results of the production of gas per ton of coal, but there is no question but that the results have been far better than with any other oven employed by me.

Yours truly,
(Signed) R. BAKKER.

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CONSULTING GAS ENGINEER,
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Improved Retort Settings Supplied, or Retorts Set by Contract.

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[From the AMERICAN GAS-LIGHT JOURNAL, Oct. 2, 1877.]

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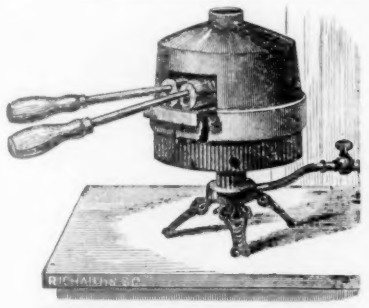

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450-2t [Box 1436, Joliet, Il

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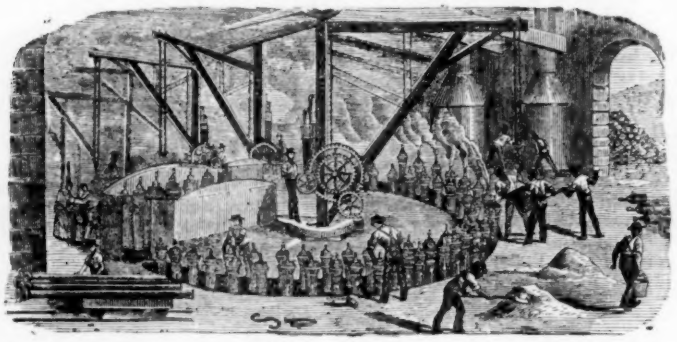

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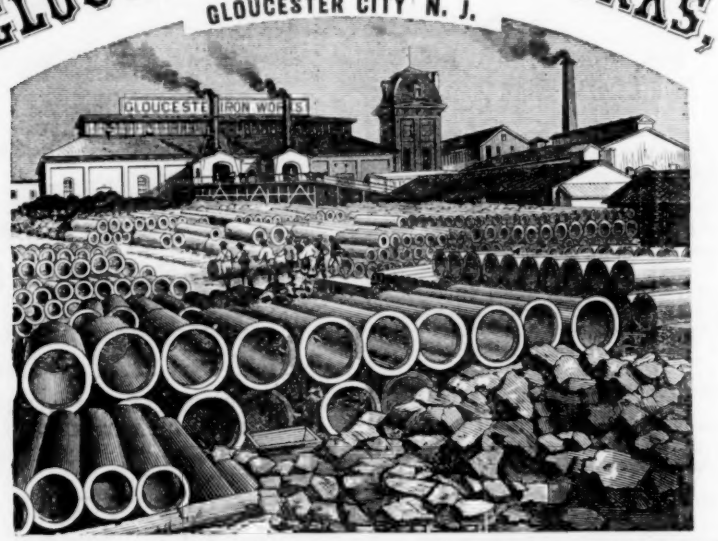

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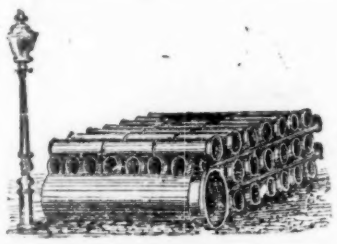

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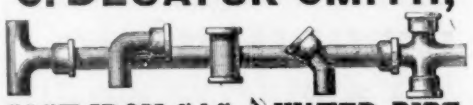

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Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

☞ FITTINGS FOR GAS AND WATER MAINS ☜

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Of Pittsburgh, Pa.

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YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their ustly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation. on most favor gble terms.

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Branch Office—C. & P. RR. Coal Pier,
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WILLIAM A. McINTOSH, President.
A. CARNEGIE, Vice-President.
W. P. DE ARMIT, Treasurer.
THOMAS AXWORTHY. Agent at Cleveland, Ohio.

351-1y

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.
CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

224-1y n

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OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

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Company's Office, 15 German St., }

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TYRCONNELL GAS COAL.,

MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

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SHIPPING POINT—Baltimore, Md.

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Celebrated Gas Coal

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GAS COALS.

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PENN GAS COAL COMPANY

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COAL, CAREFULLY SCREENED,

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CANNELTON CAKING COAL.

MAXIMUM YIELD, **5.06** cubic feet of Gas per pound of Coal—A yield of **4·78** cubic feet per —gave **16 14-100** Candle-Power.

COKE, of very fine quality—**1453** pounds produced from one ton of coal.

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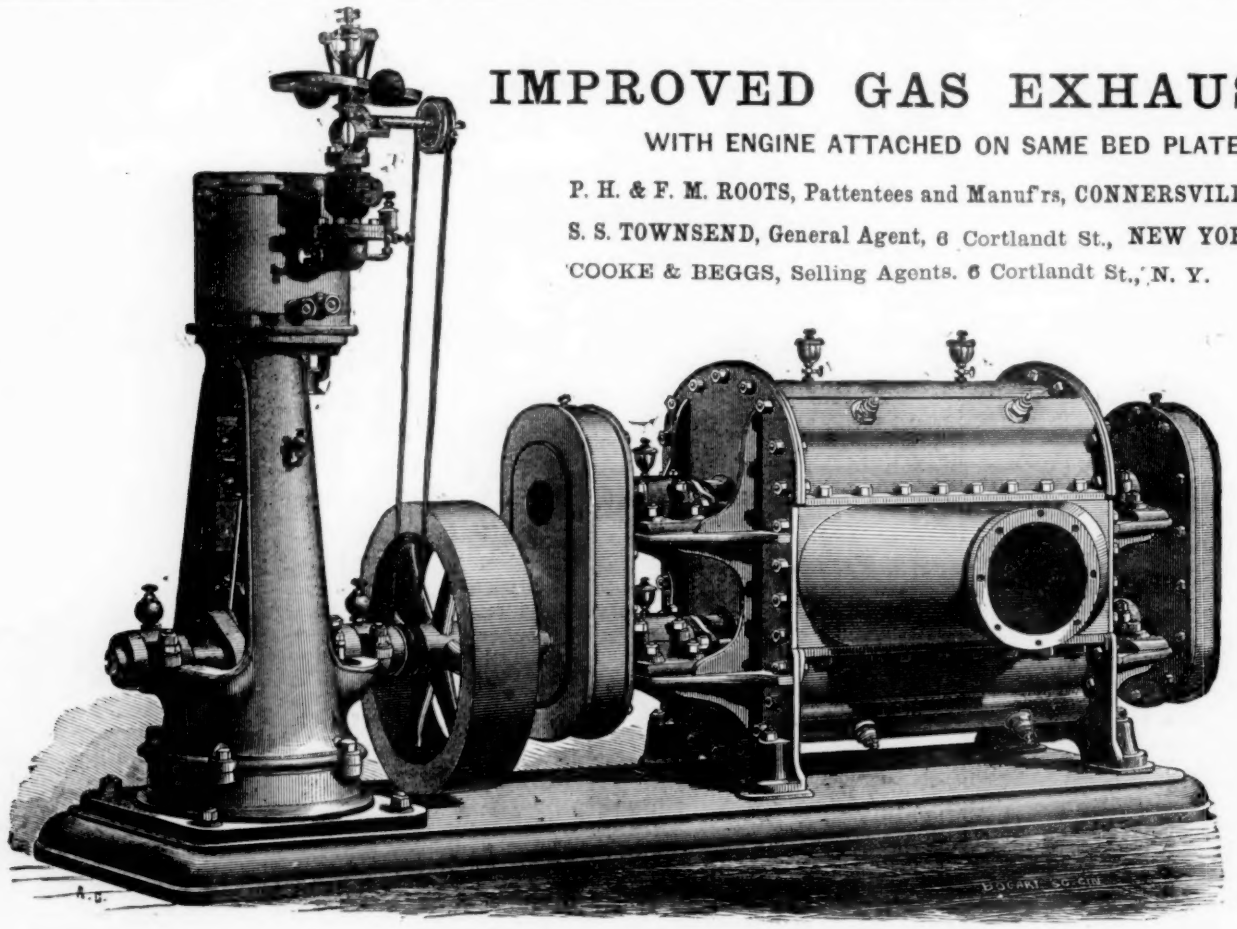

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MANUFACTURERS OF

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ALWAYS ON HAND.

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Manufacturers of Clay Gas Retorts and Retort Settings,

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THIS IS THE ONLY HAND MACHINE IN THE WORLD FOR CUTTING

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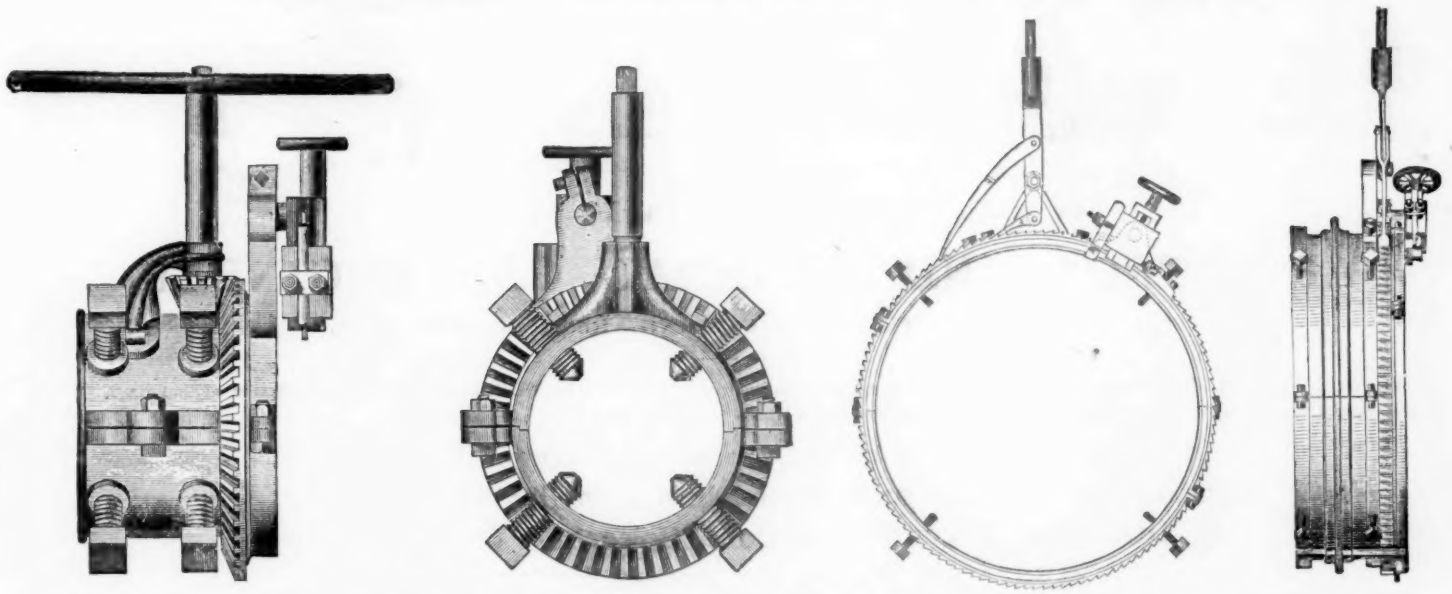

It will cut Cast or Wrought Iron Pipe, Shafts, or Columns of any size, making a clean, smooth, and square cut. Also,

A Continuous Line of Pipe in a Trench or Building.

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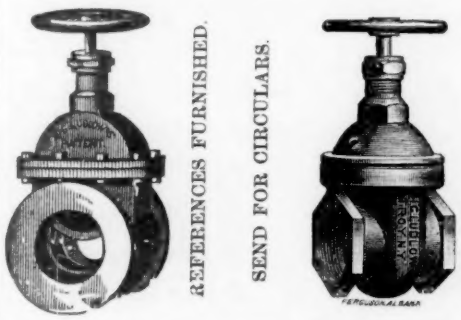

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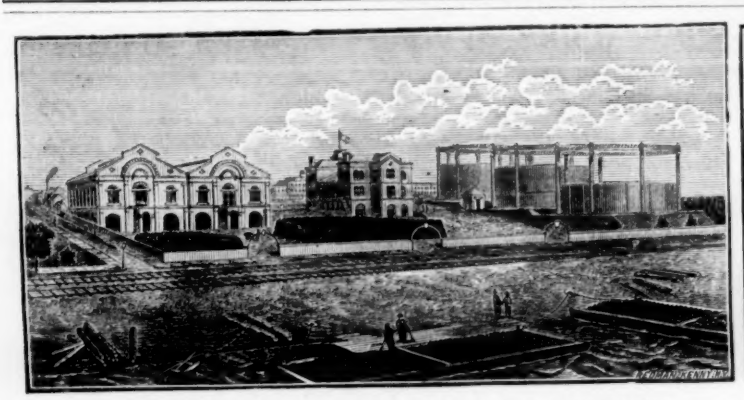

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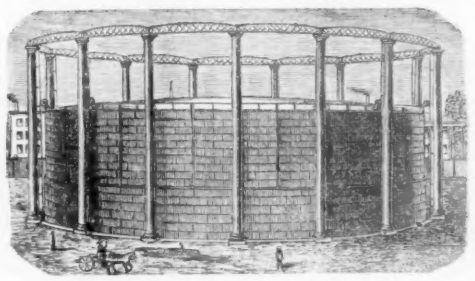

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With cast iron guide and suspension frames. GAS GOVERNORS or REGULATORS, STREET MAINS, from 1½ to 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

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431—1y

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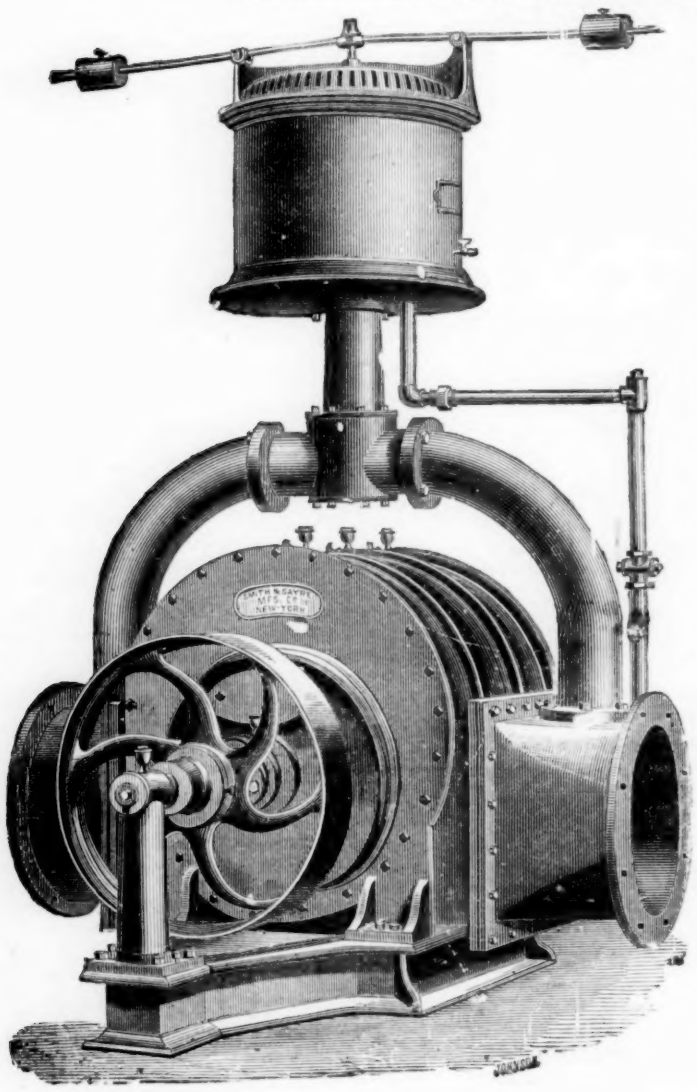

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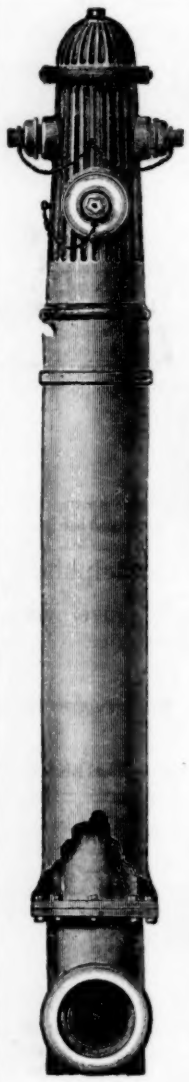

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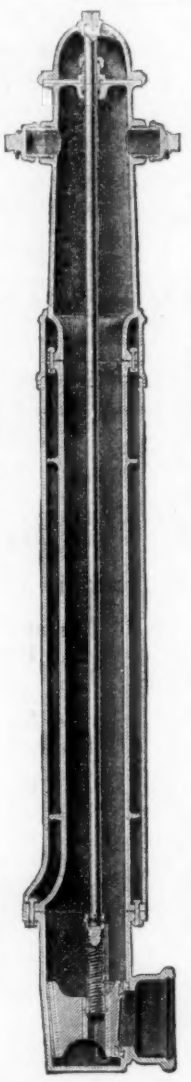

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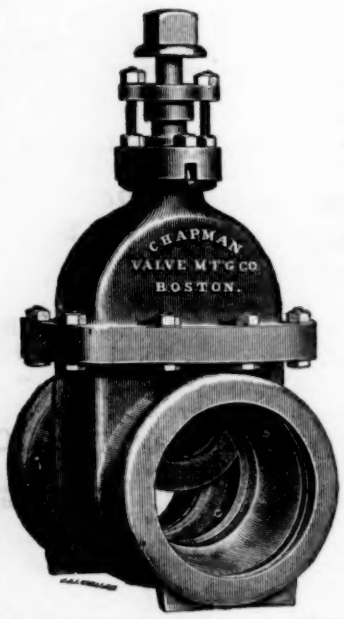

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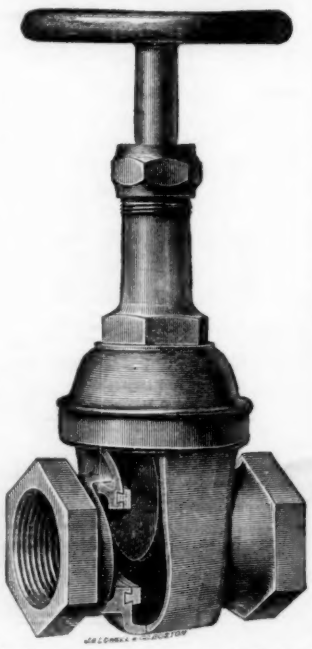

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